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What is Scientific Management?

IT may seem somewhat strange that this question should be asked after the expression "scientific management" has become so common in our industrial vocabulary. It took many years for some men of the older school to believe that it was more than merely a matter of words—words used by men who had little respect for the methods by which their forebears had built up our great industries.

Even the word "Efficiency" with a capital E and the term "Business Efficiency" were unacceptable to them, because their persistent use seemed to be more derisive than complimentary towards those to whom credit was due for great achievements here and overseas.

Of course the times have changed and competition from within and without, together with the growth of mammoth organisations in place of many smaller ones, have swept the whole industrial world into quite a new order of things, rendering science and scientific method, and the modern outlook that these stimulate, absolutely essential for all who wish to hold their own. There has been the danger, and still is, of our indulging more in talk than in action in our attitude towards the scientific management of business. Few industries can succeed to-day, however, unless they are prepared to engage trained minds to plan their operations and to employ the methods and equipment that study and experience have proved science to be able to bring to their assistance.

We notice that Lord Leverhulme has recently been answering the question, which he says often arises, as to what is meant by the term "scientific management." In his view—and the character and volume of his interests fully entitle him to speak upon the subject—it means the scientific approach to the problems of business management and administration; that is, looking at business problems with the same kind of mental outlook as is used in scientific problems.

We note with satisfaction that he holds that we should not give the attitude too narrow a definition. Those of our manufacturers and managerial staffs who are acquainted with the curriculum of the "Business Administration" courses that are included in the London University training schemes know how thorough is the equipment with which young men are being prepared for lending a hand in the more efficient conduct, development and control of modern industry and trade.

Whether it be in the employment of materials, the organisation of labour and staffs, budgeting and statistical research, or the preparation of schemes for expanding our trade throughout the world, the conviction seems now almost incontrovertible that in the practical and reasonable application of scientific thought and management lies one of the greatest of the weapons in the armoury of our industrial organisations.

As experience has shown, however, it is far from satisfactory if, after we have used scientific methods in amalgamated concerns and gained rewards thereby in the matter of production, we fail to co-ordinate and scientifically manage the various operations of a purely commercial nature within the individual parts of the resulting organisation.

Battery Transport

LANCASHIRE provides a most suitable field for a show of electric vehicles, not so much on the grounds of what has been already done there—though that is relatively meritorious—or of the rich potentialities of the area, as on account of the vigorous spirit with which all concerned are co-operating to ensure the preliminaries of success. The underlying idea of the Area Vehicle Committee in promoting the exhibition to be held at Salford on January 27th and 28th is to familiarise the public with the electric vehicle as the proved success that it is rather than as a promising experiment. An essential first step has been the establishment of a uniform tariff, the absence of which, there is evidence to show, has presented a stumbling block to potential users operating in several areas. Those under-

takings that have avoided the inconvenience (if not annoyance) that consumers may suffer through limiting the charging period are probably foreshadowing general practice, as the occasions on which charging would not be done during off-peak periods must be very few. An encouraging feature of recent progress is the number of distributing concerns which are adopting electric vehicles for the first time and propose to increase their fleets as other forms of transport fall due for replacement.

Training Intelligence

THERE may be no right way and several wrong ways of educating engineering students, as Principal B. Mouat Jones suggested at Manchester, but a solution of the problem is most likely to be reached in the collaboration between educationalists in his position with engineers having the industrial experience of Dr. A. P. M. Fleming, coupled with the faith in the intellectual capabilities of the engineer expressed by Mr. J. W. Thomas in his chairman's address to the I.E.E. North-Western Centre. The Institution itself has an essential part to play, even if its action is sometimes that of a "catalyst," for as its President, Sir George Lee, reminded the Manchester gathering, its primary object is education, although its influence in securing the most suitable entrants to the profession seems to be overlooked sometimes. The new theories, as well as new practice, that so often furnish the themes of the papers it provides for discussion are themselves evidence of the need for the electrical engineer to develop the power of adapting himself to change. He may, moreover, achieve a position in which he has to rely more on the exercise of other faculties to which his technical knowledge forms little more than a background. Any limiting of the outlook due to early specialisation is therefore to be avoided.

Electricity in Council Houses

THE almost universal use of electricity for lighting has led tenants of Council houses to demand this benefit in their homes. There appears to be, however, considerable confusion and difference of opinion as to who should pay for it. In many cases the onus falls on the Housing Committee, in which event the cost may be added to the rent. At Great Yarmouth power plugs are to be installed if the Electricity Committee is willing to bear the cost. When the same suggestion was made at Littleborough the chairman said that the undertaking could not subsidise one section of the public at the expense of the rest. Another vexed question is that of compensating tenants who have installed electricity at their own expense where the Council is now installing electricity in its property. We do not see why compensation to an agreed value should not be paid where the tenant has carried out an installation, at least to the value of the saving to the Council. This view appears to be held by the Paisley and Dundee Councils, but the Glasgow Corporation has declined to compensate tenants.

Television

ALTHOUGH television is not at present making very rapid headway there can be no doubt that it possesses a certain future. At present two things militate against progress —the brevity of the television programmes of the B.B.C. and the high cost of the receivers. It is generally believed that a great increase in the sale of sets would, as in other spheres, lead to a drastic reduction in price, but Mr. H. J. Shaw, addressing an A.M.E.E. audience last week, rather damped that idea. He said that the complicated nature of the equipment made it impossible to produce it at a very low price; he did not say, however, that there would be *no* reduction. Some would-be "viewers" hesitate on account of possible disaster to the cathode-ray tube involving expensive replacement. The nervous should be reassured by Mr. Shaw's statement that more than a year's experience had produced no trouble in this direction whatever. Moreover, his company had a scheme for replacing tubes at a low cost. The immediate future of television seems to depend most on an extension of the service and the B.B.C. appears to be doing its best to secure more funds to achieve this.

The First Ten Years

A NECESSARY corollary of the recent I.E.E. discussion on electrical engineering education (which it is to be hoped will not be allowed to drop) is that the material prospects for students shall be good. A contribution to experience on this point is made by a sub-committee of Old Centralians, presided over by Sir Alfred Chatterton, in a report on the first ten years of old students' careers after leaving the City and Guilds Engineering College. While there would appear to be little unemployment, the remuneration has fallen recently. The sub-committee attribute this partly to the effect on the average of the fewer opportunities now offered to earn relatively high salaries overseas, and partly to the need that drives many scholarship holders, without private resources, to accept work at subsistence rates. Such students have often not the means to mix on equal terms with their fellow students and leave a college with an "inferiority complex" that prevents the proper development of their abilities, which means so much more than the acquisition of knowledge. It is suggested that a smaller number of scholarships of greater value would produce better results.

British Museum Lighting

THE announcement that as from January 31st the Reading Room of the British Museum is to remain open until 7 p.m. instead of 6 p.m. follows upon a recent improvement in the lighting. The extension led us to hark back to the early days of electrical illumination, when it was called *the* electric light. Reference to the ELECTRICAL REVIEW of September 9th, 1887, shows that the electric light was put into operation as from September 1st in the Reading Room and galleries of the Museum. At the same time the open period was extended to 8 p.m. So, it will be seen, if the lighting has since been improved it has not effected a complete return to the former opening hours.

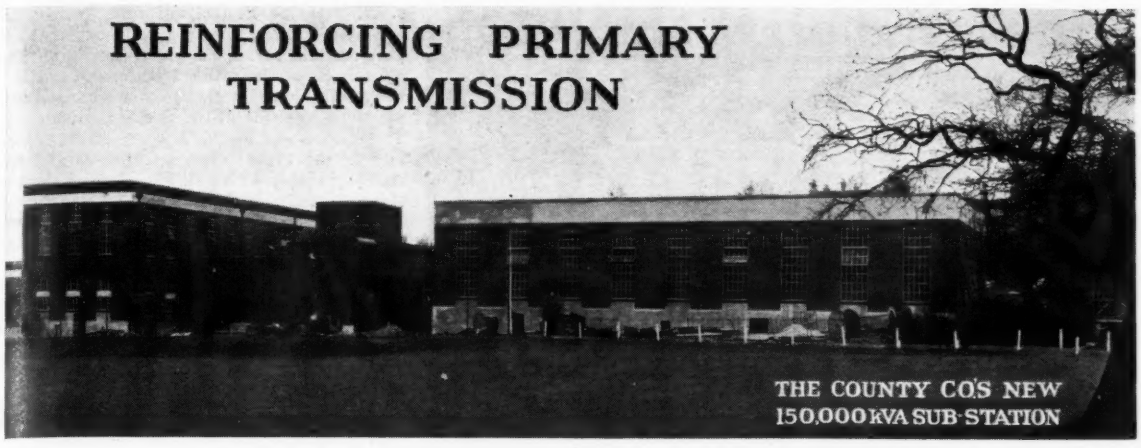
A Good Year

THE preliminary Board of Trade returns of British exports and imports during 1937 show that definitely electrical exports—the ramifications of the industry extend to a multitude of allied products—amounted in value to £18½ million. As this is above the average for the seven years immediately preceding the depression, British manufacturers may justifiably be said to have recovered the ground lost in the calamitous period that ensued. Last year's increase of £3½ million over 1936 was partly due to the rise in commodity prices, but there was a substantial margin of genuine expansion. A fair guide is the improvement of 12 per cent. in the weight of machinery exports, the value of which increased by 16 per cent. A good augury for the future is the marked upward trend in the closing months of the year, which was something more than seasonal.

Sound Medical Advice

IT is the duty of public medical officers of health to encourage any movement which tends to the physical well-being of the people in their charge. But not all of them speak out so freely as the Barnsley M.O.H. (Dr. J. L. Burn) what must constantly be in their minds. Dr. Burn, lecturing recently, pointed to the unique attribute of electricity of giving light without forming injurious products. He deplored the inadequacy of electrical installations even in the most modern houses and said that in future "public health would be improved not by bottles of new medicine but by new ways of life, new amenities and new ways of doing things, such as the magic of electricity could supply."

REINFORCING PRIMARY TRANSMISSION



[*Elec. Rev. photo.*

LARGE-SCALE load growth within areas already served by transmission and distribution systems is presenting a new set of problems to the distribution engineer. By the courtesy of Mr. W. J. H. Wood, engineer-in-chief to the County of London Electric Supply Co., Ltd., we were able recently to see at the new distribution centre at Streatham how the unprecedented demands of the area to the S.W. of London are being met by way of main transmission and distribution.

When supply was commenced from the Barking power station in about 1925 the load in the S.W. London area was dealt with by 33-kV feeders to two major sub-stations—one at Peckham (48,000 kVA) and one at Mitcham (50,000 kVA). Reinforcements were subsequently effected to the 33-kV system from time to time, but in 1934 the load had grown so much that a more comprehensive scheme of major distribution was called for.

The company consequently came to the decision to embark on a scheme employing 66-kV transmission from Barking to Streatham, and the site at Valley Road was chosen for the new capital sub-station because it was peculiarly suitable as a point from which the existing 33-kV transmission could most usefully be further reinforced. This new sub-station is now practically complete and is on load. It has a capacity of 150,000 kVA and is probably the largest sub-station engaged on normal supply area distribution work in this country.

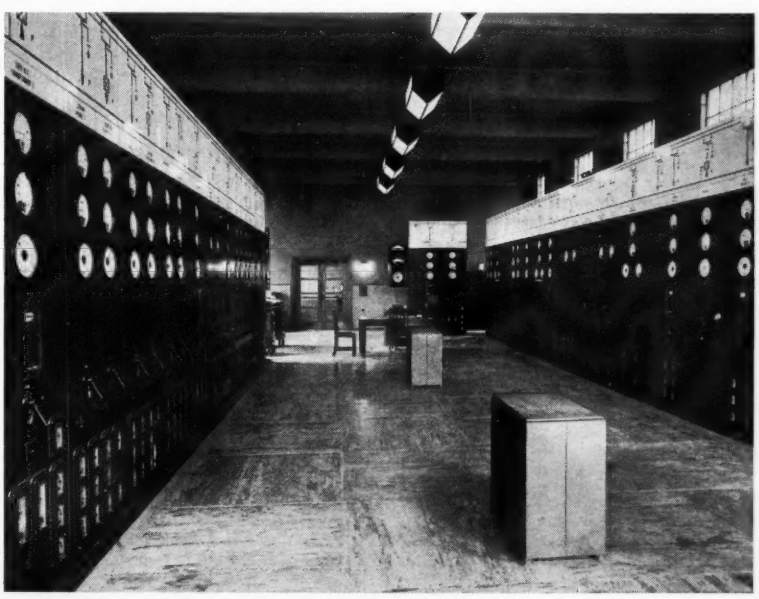
Pirelli - General, Callender's, B.I. Cables & Henleys acted as cable contractors. Three 66-kV oil-filled cables are each capable of transmitting 50,000 kVA over a route length of sixteen miles from Barking. Each feeder, together with its 50,000-kVA step-up transformer at Barking and its 66/33-kV transformer of similar capacity at Streatham, is considered as a complete transmission unit for the delivery of load at 33-kV at the new sub-station, no 66-kV switchgear being employed. Each step-up transformer is provided with overload and earth-leakage protection on the 33-kV side and earth - leakage protection on the 66-kV side. Each 66-kV oil-filled feeder is equipped for split-pilot protection, the necessary current transformers being mounted over the oil-filled bushings at either end.

The step-down transformers are fitted for restricted earth leakage, directional and over-current protection, the whole transmission unit being provided with the necessary inter-tripping devices so that both ends of the system would be isolated immediately in the event of a fault occurring either on the feeder itself, the step-up transformer or on the step-down transformer.

The sub-station has been constructed in three main sections. First, there is a two-storey building on the upper floor of which are located the sub-station operating room and a system control room for the greater area served. The sub-station operating room houses control boards for both the 33-kV and 11-kV switchgear, and an interesting development represented by both boards is the flush-type instruments. Above each board is a diagrammatical representation of the switchgear circuits provided with electrically operated switch-position indicators.

On the ground floor there is the 11-kV switchgear, which is of the Reyrolle B4 type and has a rupturing capacity of 350,000 kVA. It has duplicate bus-bars and is remotely electrically operated from the sub-station operating room. There are nineteen feeder and transformer circuit-breakers, and all the feeders are provided with Merz-Beard and back-up overload protection.

On the same floor there is also the low-medium voltage switch-room which houses the d.c. and a.c. distribution equipment for the control apparatus, the sub-station heating and lighting and auxiliary supplies and for the fire-fighting installation. Adjacent to this room are two 300-Ah, 110-V Chloride lead storage batteries which supply the switchgear operating equipment and serve as a sub-station lighting stand-by supply.



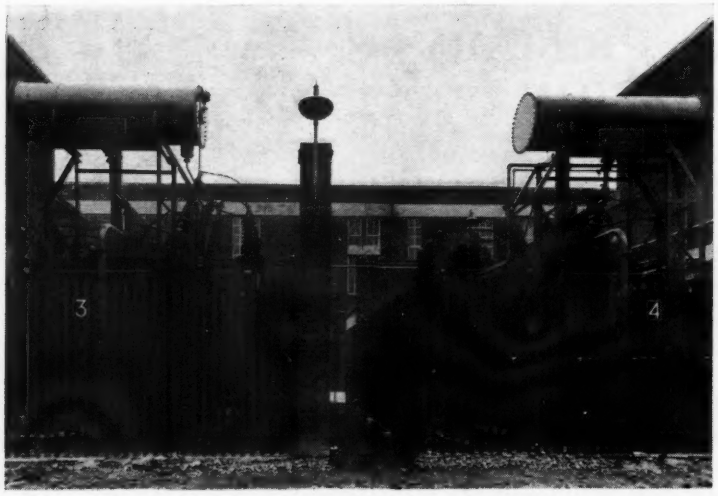
[*Elec. Rev. photo.*

Sub-station operating room showing 11-kV control board (right), 33-kV board (left), and summation equipment on 66-kV feeders

The second main section of the sub-station is the 33-kV switch-house. There are twenty - two feeder and transformer switches, all of the Reyrolle R5 type, with a rupturing capacity of 750,000 kVA. Duplicate bus-bars are provided and the switchgear is remotely electrically operated.

The outgoing 33-kV feeders are equipped with Merz - Beard and back - up overload protection, the operation of each switch being indicated above the corresponding control panel in the operating room.

The third part of the "sub" consists mainly of concrete rafts on which stand the transformers—all outdoor and supplied by the Hackbridge Electric Construction Co., Ltd. The three 66/33-kV equipments are oil cooled, the necessary oil circulation being effected by two pumps, the first of which starts up automatically when the transformer is put into commission. The second pump is actuated by a mercury switch which is controlled by a thermostat so that it is brought into operation



Two of the 50,000-kVA, 66/33-kV transformers [*Elec. Rev. photo.*

when the transformer temperature reaches a predetermined point. These two pumps circulate the oil through four Serck coolers, 600 gal. of oil per minute being dealt with when both pumps are at work.

Differential pressure gauges are connected across each cooler to check the circulation of oil, and inlet and outlet thermometers provide indications that the requisite cooling is being obtained. These transformers are also fitted with oil and winding temperature indicators which are also connected to alarm circuits in the operating room. Oil-level alarms and Buchholtz protection equipment are provided as well. On-load tap-changing is not provided for in this instance because the step-up transformers at Barking are equipped for such regulation.

There are also four 15,000-kVA, 33/11-kV transformers which serve for secondary e.h.v. distribution from the sub-station *via* the 11-kV switchboard. These are equipped similarly to the 66/33-kV transformers, except that they are fitted with electrically remotely operated on-load tap-changing gear of the induction-regulator type to ensure smooth voltage changes, and also with delayed tap-change and regulator chamber temperature alarms. These transformers are fitted for earth-leakage protection on the 33-kV side and restricted earth leakage and directional protection on the 11-kV side. Both sides are fitted with back-up overload protection.

For the sub-station lighting, heating and auxiliary supplies there are three 300-kVA transformers fed from the 11-kV board and supplying at 400/230 V, three phase. All the transformers are connected delta-star, the neutral points of the 50,000-kVA equipments being connected to earth through either grid or liquid resistances by means of e.h.v. iron-clad neutral earthing switchgear.

All the lighting, heating and auxiliary supplies are taken from the 400-V system, but the lighting supply is further transformed to 110 V to permit suitable change-over arrangements for a battery supply in cases of emergency. The change-over switch is operated automatically in the event of an a.c. failure and the stand-by supply serves all the essential parts of the sub-station. All supplies for the switch closing and tripping, indicating and d.c. alarm equipment are taken from a main d.c. distribution board to which are connected two motor-generator sets. These serve for battery charging, but they are only used very occasionally because the batteries are normally trickle-charged by a Westinghouse metal rectifier.

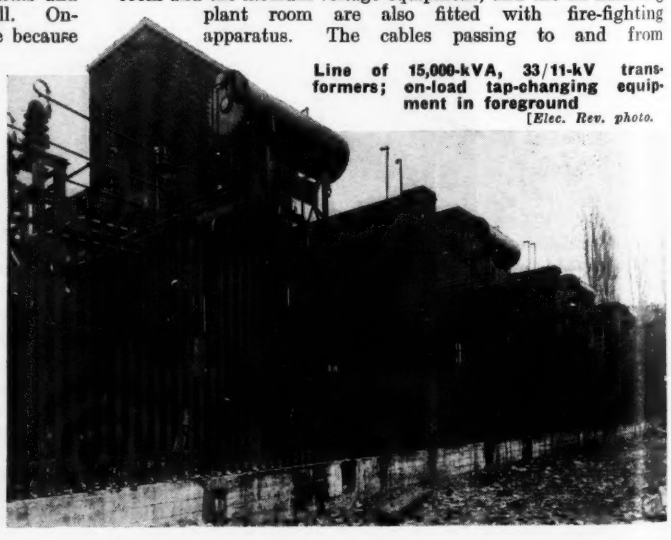
Fire Protection

Special precautions have been taken to minimise damage to the plant in the event of fire, including sectionalising of both the transformers and the switchgear. The transformers are protected by a Mather & Platt "Mulsifyre" fire-fighting system, and each unit is separated from its neighbour by a substantial brick wall. Such a wall completely separates the two sections of the 33-kV switchgear, and the 11-kV equipment is "split" by brick walls and fireproof doors, so that in each case there are virtually two switch houses. The bus section and bus coupler switches of both the 33-kV and the 11-kV switchgear are further sub-divided into separate compartments by means of fire-proof doors.

All the switch houses, including the neutral earthing switch room and the medium-voltage equipment, and the oil handling plant room are also fitted with fire-fighting apparatus. The cables passing to and from

[*Elec. Rev. photos.*

Left: The north 33-kV switch-house; fire-screen doors, isolating bus section and coupler switches at far end. Right: North 11-kV switch-house showing fire-protection doors and south switch-house in the distance



Line of 15,000-kVA, 33/11-kV transformers; on-load tap-changing equipment in foreground
[*Elec. Rev. photo.*

Cooker Design and Maintenance

What consumers ask for

TWO papers were considered at the January 20th meeting of the Institution of Electrical Engineers in London. One of them, by Mr. O. W. Humphreys (G.E.C. Research Laboratories, Wembley), is chiefly devoted to those aspects of design which affect cooking performance. The author expresses the opinion that the next few years will see important changes in connection with both external appearance and oven design. Some manufacturers are already being influenced by a demand for cookers whose lines are more in harmony with present-day conceptions of artistic form, and with the growing popularity of thermostatic oven control new problems arise in connection with oven heating, ventilation, and lagging, which may well result in a complete revision of present practice in these directions.

Since the majority of cookers are disposed of by simple hire or long-period hire-purchase, the supply authorities naturally demand a robust construction which will ensure a long life, and frequent changes in external appearance are also deprecated owing to considerations of obsolescence.

The oven interior is preferably welded so that steam is prevented from escaping into the lagging, and the joint between the oven lining and the front frame should be made in a steam-tight manner. Castings are less liable to warp and also offer the great advantage, which is of particular value during a period of rapid evolution, that they can be made from relatively inexpensive patterns which can be fairly readily modified, whereas steel pressings necessitate expensive tools which are not easily altered.

These expressions of the cooker maker's and the customer's points of view possess more than ordinary interest

Where an oven is to be thermostatically controlled, convective heating offers very definite advantages, but with manual control the choice of the heating system is largely a matter of personal taste. With no top heat, control is by a single switch offering three alternative element connections, of which two only ("high" and "low") are at all commonly used. In top-and-bottom-heated ovens the top and bottom elements are frequently controlled by separate three-heat switches, and the top element is also used for grilling. Of the nine alternative element connections which are available, five are quite commonly used. The close control thus made possible is of value to the expert cook, but to the average cook the selection of the best combination of switch positions presents some difficulty and is only learned as a result of considerable experience, or very detailed instructions.

No difficulty should be experienced in so designing oven elements that the wire temperature is below 800 deg. C. with the oven at its highest cooking temperature. Since at this temperature the life of the element should be practically indefinite, it is not worth while to make any appreciable sacrifice in other directions solely to ensure very quick element replacement in the event of failure.

With electrically heated ovens it is not necessary to maintain a circulation of air through the oven, but some provision for the removal of the large quantity of water which is evaporated during most baking operations is required. "Steaming" at the vent is frequently regarded as indicating a defect in the cooker. Actually it may merely arise through the use of a particularly well-fitting door, and the presence or absence of this phenomenon has no bearing whatsoever on the quality of the cooking. Vents are provided to enable steam to escape from the oven. Whether this steam condenses just outside the vent, or on the walls of the kitchen, or is absorbed by the air in the kitchen, is of but little importance.

From the point of view of economy in energy consumption, it has been shown experimentally that lagging thicknesses considerably greater than those now commonly used would be well justified. For example, the energy consumption during the cooking of a series of meals in an oven lagged with 3 in. of slag wool was found to be approximately 25 per cent. lower than in an identical oven with only 1 in. of lagging. But account must also be taken of capital costs, and the limitations on overall dimensions.

Owing to the necessity of protecting the thermometer from damage the bulb of the thermometer is usually recessed into a cavity formed in the door lagging. The temperature in this cavity is inevitably lower than that of the main body of air in the oven, but to an extent which depends on a variety of circumstances and varies between quite wide limits. As an accurate knowledge of temperature is of the greatest importance at the time that the food is inserted in the oven, it is customary so to calibrate the thermometer that it indicates true oven temperature during initial heating from cold. Thereafter the thermometer readings bear an indeterminate relation to oven temperature and are of little real value, but this is only a serious inconvenience when it is desired to carry out in succession two cooking operations requiring substantially different temperatures. Careful attention must be given to the mounting of the thermometer in the oven door.

Reinforcing Primary Transmission (*Concluded from previous page*)

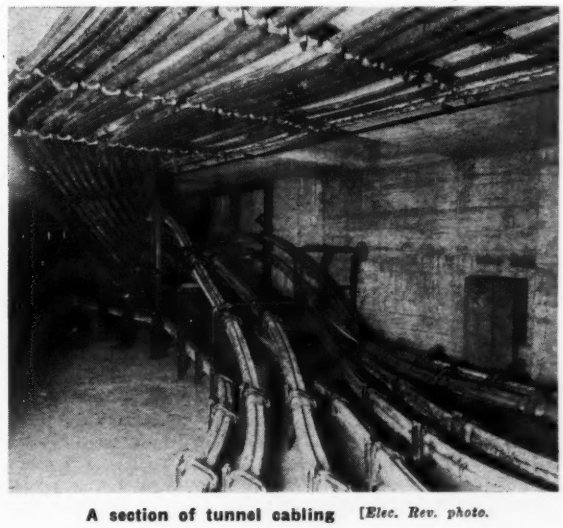
the two halves of the 33-kV and 11-kV switch houses are run in two separate and distinct cable tunnels. All the internal cables have been supplied by the Enfield Cable Co., Ltd. Under the main switches are pebble-filled oil-drainage and "fire muffling" pits designed to carry spilt oil away from the equipment *via* a suitable duct at the bottom of the pits.

To deal with the unusual problem of oil handling in a sub-station of this size a "Streamline" oil-filtering plant has been provided. There are two 5,000-gal. containers for the accommodation of clean and dirty oils, respectively, and a smaller container is provided to receive new oil which, if necessary, may first be filtered and then passed into the clean-oil container. Clean- and dirty-oil pipe lines connecting the oil-handling plant and the switch houses and transformers facilitate the oil-handling work, flexible hose pipes being employed to connect up to the system as required individual switches or transformers.

Consequent on the magnitude now reached by the networks in the company's greater area, central system control has now been established for which the Valley Road capital sub-station has been chosen as headquarters. All essential private telephone lines have been diverted to the new system control room, where a suitable exchange board permits immediate communication with any of the sub-stations in the greater area. A large system control diagram is being erected on which will be shown the network over which the system control operates, and all instructions regarding the operation of the systems will emanate from this control room.

Thermostatically controlled tubular heating throughout the sub-station is supplemented in the system control room and the sub-station operating room by large centrally placed convector-type heaters. The lighting scheme in the system control and sub-station operating rooms has been designed to eliminate glare. The main lighting from large central trough-type ceiling suspension units is supplemented by wall fittings which, in the case of the operating room, provide adequate lighting at the back of the control boards when work has to be carried out on the small wiring. The outdoor areas, in particular the transformer section, are well served by flood-lighting projectors.

Messrs. Merz & McLellan were the consulting engineers responsible for the design and construction of the works, in collaboration with the company's engineers.



A section of tunnel cabling [*Elec. Rev. photo.*

The rate at which heat is transferred to a charge in an oven depends in part on the air temperature, but in part also on the temperature of the surrounding surfaces from which it receives heat by radiation. It is therefore impossible to define heating condition completely in terms of air temperature, and this difficulty is reflected in the widely differing temperatures which are recommended by various cooker manufacturers for the same operation.

The difficulty could be overcome by calibrating the heat indicator in terms of heating condition instead of oven temperature, with a scale of "heat numbers" in place of degrees F. This is the common practice with thermostatically-controlled gas cookers, and has been adopted by some manufacturers of thermostatically-controlled electric cookers, but as there is at present no agreed standard scale of heat numbers definitely correlated to heating condition (the gas industry uses at least six different scales) the limitation of the present arrangement is perpetuated.

Thermostatic Control

It may be argued, apparently with a fair amount of justification, that the manual control of electric ovens is so simple that the thermostat cannot possibly have much to offer, but experience shows this view to be mistaken. An important difference between manual and thermostatic control is that whereas with the former cooking is usually carried out with a falling temperature, with the latter the temperature is maintained at a steady value throughout the whole operation. As a result of this, the oven temperatures required with thermostatic control are lower than those which are recommended for the *commencement* of cooking with manual control. Great care must be exercised in choosing a thermostat to ensure that it is really suitable for the particular cooker to which it is to be fitted. It is of the first importance that, once the thermostat has commenced to operate, cooking results should be independent of the time at which the food is inserted in the oven. To achieve this, the amount of heat absorbed by the charge must be the same whether the charge is inserted immediately after the first cut-out of the thermostat or at any later time. At first sight it might appear that this condition would be met provided the change in oven temperature between opening and closing of the thermostat was small. With an oven heated entirely by convection, and the rate of transfer therefore depending only on air temperature, this would be true, for a small change in temperature would represent a very small alteration in heating condition. If radiation plays any important part, however, it is no longer the case, for since the radiating surfaces are usually associated with bodies of relatively low heat capacity, they change in temperature very rapidly when the thermostat operates.

Consequently the rate of heat-transfer is much greater during the "on" period than it is during the "off" period, and the only way to ensure the same total heat-transfer during a given time is to employ a thermostat which operates with a very short time cycle. A further objection to a long time cycle is that it may lead to overheating, and consequent burning, of the parts of the charge in closest proximity to the radiating surfaces. With the general run of present-day cookers this cycle should not much exceed 5 minutes.

The performance of a thermostat is very largely influenced by its position in the oven. The best position depends on the type and disposition of the heating elements, and the system of ventilation employed.

The history and development of boiling plates is reviewed and the different types are discussed. With regard to simmering requirements, the author refers to the difficulty of determining the best compromise by laboratory experiments. He says that experience will have to be the final criterion, but so far indications are that a loading somewhat lower than the present 250 W might be more generally useful.

Maintenance Costs

The second paper is by Mr. J. N. Waite (Hull Corporation), who states reasons for his belief that the cooker offers the largest market for electricity supply in the domestic field. The author suggests ways and means of developing this market, and gives detailed information about the maintenance cost of domestic cookers.

He first discusses economic aspects and tariffs, stating that in the City of Hull 85 per cent. of the houses are assessed at £15 or under, while 58 per cent. are assessed at £10 or under. It is reasonable to assume that the percentages for this country as a whole will not be greatly different, and it follows that domestic electrification must cater for the working-class house.

In the author's undertaking 15,538 cookers have been placed in service in less than eight years, and 85 per cent. of these are in working-class houses. It has been demonstrated beyond dispute that cooking by electricity is as cheap as any other method available, and therefore there is no valid reason why every house within a supply area should not be equipped with an electric cooker. The author regards the electric cooker as the most valuable piece of apparatus in the campaign for domestic electrification, despite the fact that often, owing to the innate conservatism of the average housewife, it is the most difficult of all electrical services to get adopted.

So far as working-class houses are concerned, the only possible way of marketing electric cookers is by means of straightforward hire or rental, which should include the provision of the necessary wiring and of the control switch. In Hull the rental of apparatus is in a number of cases collected weekly with the house rent. In other cases a variation of the "all-in" tariff with a slot meter is used, but in all cases the standard rental is paid by the consumer.

If the methods adopted bring in a satisfactory volume of business they may be regarded as correct, whether they are unique or otherwise, for the final criterion is "Does it work?" To-day, the domestic electric cooker is a reasonably good and reliable piece of apparatus, and if an undertaking is not making progress with this important phase of electricity supply the fault does not lie with the cooker.

Four sizes were necessary to satisfy the household requirements of the Hull area, and they are all of one make, the various sizes of cookers being outwardly similar. Changes have taken place in elements, boiling-plates, &c., but the changes are not noticeable to the normal consumer. The author's standpoint with the manufacturers is that, while he does not desire to check development, any proposed change that would be noticeable to the consumer must have very substantial economic or practical reasons in its favour before it can be considered. The policy of restricting purchases to one make, and negotiating the purchase price with the manufacturer as and when necessary—preferably a review each year—gives as favourable a purchase price as any other method.

What is wanted is a cooker which will satisfy the reasonable requirements of the average user, at the lowest price consistent with reasonable reliability. Any competent cook can demonstrate that equally satisfactory oven cooking can be done with any arrangement of oven elements.

The Boiling-plate Problem

The critics of the boiling-plate are evidently not students of human nature. The housewife will adjust her habits to the means at her disposal, and, having done so, will forget all about quick boiling. A quick-boiling boiling-plate is a desirable feature, but the importance of quick boiling is much overrated, and if quick boiling means a substantial increase in cost, or loss of reliability, then it is not so desirable.

A temperature indicator for the oven is a very desirable feature, and should always be fitted. The particular form is immaterial, so long as it records consistently. Automatic regulation of oven temperature has many desirable features, and is certain to be popular with housewives. Increase in the hiring charge will tend to discount this popularity. Satisfactory cooking can be done by the normal manual control, and automatic regulation may be looked upon as a good selling point. So far, the author has not found it necessary to fit it as standard, but all the cookers have been arranged so that it can be added when deemed necessary. For the poorer class of household (which forms the majority) a low rental is more important than refinements.

TABLE I.

Year.	Total number of cookers in use.	Removals (already deducted from total).	Percentage of removals to total.
1931	2,174	46	2.1
1932	4,938	414	8.4
1933	6,592	971	14.8
1934	7,406	1,150	15.5
1935	8,673	963	11.1
1936	12,010	953	7.9
1937	15,538	1,192	7.6
	Total removals ...	5,689	

The maintenance costs given are for the author's undertaking only, and are believed to include every item of cost.

The serious nature of the expense of renovations due to removals is illustrated by the figures given in Table I. The figure for total removals, expressed as a percentage of the gross total of cookers installed, is 26.8 per cent. The following is an analysis of the causes of removal: changes of tenancy, 14 per cent.; financial reasons, 8.2 per cent.; other reasons, 4.6 per cent.; total, 26.8 per cent.

The cost of removing and reconditioning for the last two years, 1936 and 1937, was £4,773, which is 27.9 per cent. of the total maintenance cost for those years, and gives an average of £2 4s. per cooker removed and reconditioned. Comparing the total maintenance cost with the average number of cookers in use, it works out at 3s. 11d. per cooker per annum. ("Average cookers in use" is the mean of the number in use at the start and finish of a financial year.)

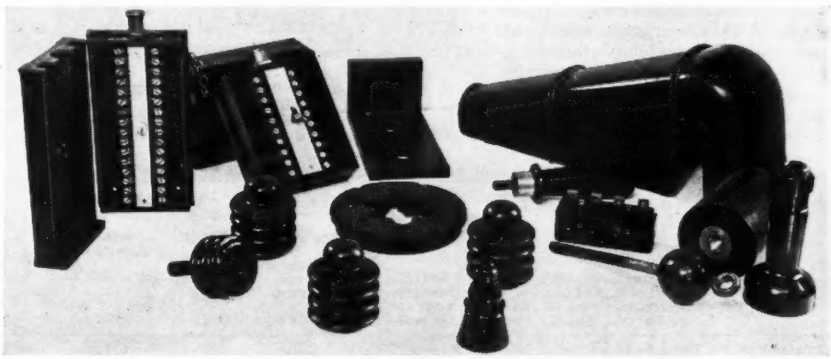
Plastics for the Electrical Industry

By W. Blakey, M.A., Ph.D., A.I.C.

Electrical and physical properties of the various types and their chief applications

IN an earlier article* a classification of plastics based on their chemical composition was proposed, and some general physical properties of the various types were set out. No mention was then made of the electrical properties of the materials, but it is obvious that to select the most suitable grade for a particular purpose a knowledge of the electrical characteristics of the material under the working conditions is desirable. While it is not always possible to predict from tests on test specimens the behaviour of a plastic moulding under actual working conditions, considerable experience on the part of the E.R.A. in the drawing up of methods of test has gone a long way towards solving this problem. In the table on the next page the general electrical and physical properties of the various types are set out, together with some of their principal applications in the electrical industry.

Materials with inorganic binder.—(1) Hydraulic cements with asbestos fillers are of inferior mechanical strength and breakdown value, but withstand very high temperatures (400-700 deg. C.). They have a very high water absorption, and are not, therefore, suitable for wet working conditions. They are used principally for arc-deflector plates and chutes in switchgear.



A group of mouldings in ebonestos bitumastic compound

(2) Lead borate with mica filler, although not as resistant to heat as type (1), is suitable up to about 450 deg. C. and has much better mechanical and electrical properties. The surface resistivity is high and the coefficient of expansion small. This material is also characterised by a low power loss and low water absorption. Its principal applications are for low-loss mouldings for high temperatures and for the insulation of domestic heating and cooking appliances.

Materials with organic binder.—(1) Natural resins are employed as binders in a very wide variety of types. Some grades (the cold-moulded and heat-hardened class) are suitable for employment at temperatures up to 150 deg. C. and are used to make plugs and connectors for heating appliances and for meter cases. Other grades are only suitable for low temperature work, but are used in large quantities for such purposes as battery boxes.

(2) Cellulose derivatives are characterised by good mechanical properties (particularly resistance to impact) and fairly good electrical resistivity, power-loss and breakdown values. They are, however, limited to working temperatures below 50 deg. C. as they are readily distorted above this temperature.

The principal applications are to lampshades, knobs and handles, radio parts and to components requiring good shock resistance, such as switch dollies and telephone cradles.

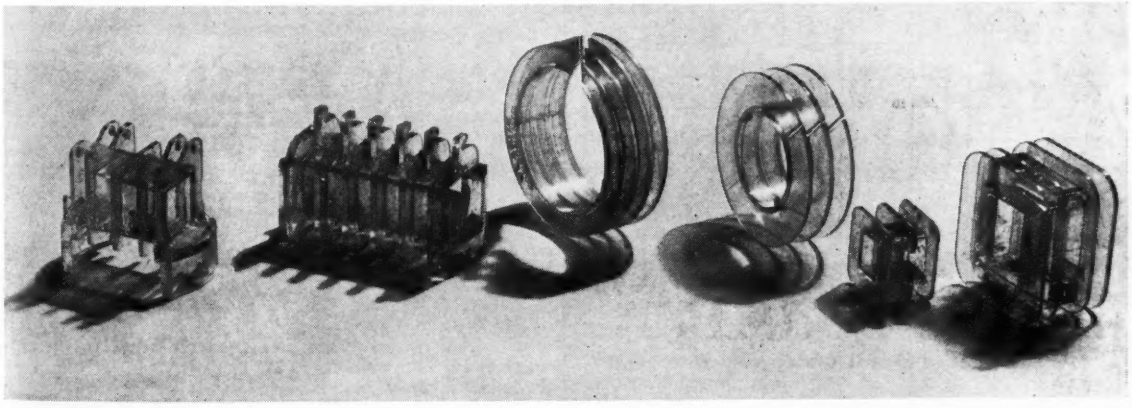
(3) Rubber compositions, including ebonite, remain in many fields still unchallenged by the newer plastics. Hard rubbers have better electrical characteristics under moist conditions than all but one or two synthetic materials and they are stronger mechanically than the normal and high dielectric grades of thermo-setting plastics. These properties have enabled them to hold their own in such fields as scientific instruments and telephone and radio parts where working temperatures do not exceed about 70 deg. C.

(4) Polymerisation products are of three principal types: Acrylic, vinyl and styrol, which are alike in that they are particularly suitable for mass production by injection or extrusion of small parts suitable for working temperatures up to about 70 deg. C. They differ somewhat in their physical and electrical properties. Acrylic and vinyl products have very good mechanical strength with moderate electrical properties, whereas the polystyrol material has excellent low-loss electrical properties but is mechanically weaker.

The principal applications of acrylic and vinyl products are to brightly coloured components which require to be of considerable mechanical strength and they are directly competitive with the cellulose derivatives in this field. Polystyrol is used for radio and short-wave work because of its extremely low loss factor at high frequencies.

5 (a) Phenol-formaldehyde condensation products, up to the present time, have constituted the great bulk of the newer plastics applied to the electrical industry. The normal grades have quite good mechanical strength, are suitable for working temperatures up to 140 deg. C. (*i.e.*, hot service conditions) and have good resistivity and breakdown values. Special grades are available with improved electrical properties for higher voltage work and other grades with improved mechanical resistance for rough usage.

The electrical applications of these plastics are exceedingly numerous. The normal grades are used for such parts as



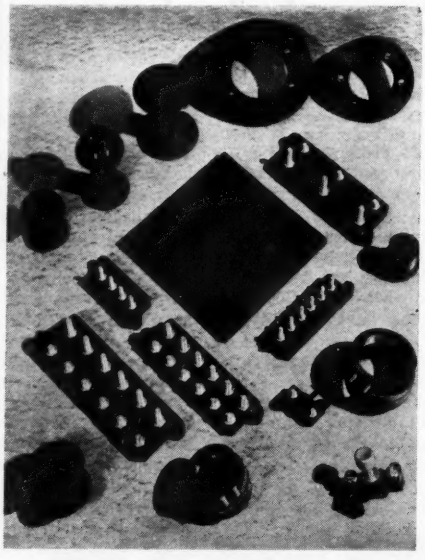
Transparent mouldings from polystyrol compound by Thomas De La Rue & Co.

* ELECTRICAL REVIEW, August 27th, 1937.

switches, plugs and sockets, lampholders, adaptors and meter-cases; the improved electrical grades for high-voltage magneto and coil parts, switchgear and radio components; and reinforced varieties for domestic appliances, such as vacuum cleaners, hair-dryers, fans and for meter-cases.

5 (b) Urea-formaldehyde condensation products have more recently appeared in grades competitive in price with phenol-formaldehyde, which has greatly expanded their use for electrical purposes. They have similar mechanical properties to the normal grade of phenol-formaldehyde compositions and are suitable for use up to 100 deg. C. Their electrical resistivities and breakdown resistance under moderate temperature conditions are similar to those of phenol-formaldehyde and they have the added advantage of complete resistance to "tracking." This enables them to be used for components such as switch-bases, which were formerly made of porcelain owing to the risk of breakdown of the earlier type of thermo-setting plastics.

Urea-formaldehyde materials are produced in all-purpose grades and are used for switches (including switch-bases) plugs and sockets, adaptors, meter cases, magneto and coil parts, switch-plates, light fittings (including shades), junction boxes, ceiling roses, and radio components.



A group of mouldings in scarab by Brook Motors, Ltd.

5 (c) Glyptal resins are principally used for insulating enamels for coil impregnation and coatings. They are characterised by good resistance to moisture and to high temperatures. Resin-bonded mica is used mostly for heating element insulation in domestic appliances.

5 (d) Casein materials have excellent mechanical strength and fairly good electrical properties under dry conditions. They are not suitable for hot service or for moist conditions. They find their principal applications for push-buttons, switches, ornamental effects and small components.

Earlier plastic troubles have now been largely overcome by rational design, but there are still some applications to which particular plastics are unsuitable. Taking the two principal types, the following limitations should not be disregarded: phenol-formaldehyde mouldings have a tendency to "tracking," and this may give trouble when there is impingement of a small arc on the moulding or where accumulation of dirt and moisture may start a leakage current. Their somewhat high loss factor makes them unsuitable for very-high-frequency components.

Urea-formaldehyde materials are "non-tracking," but their electrical characteristics fall off rapidly with rising temperature, limited to a maximum working temperature of about 100 deg. C. They are not suitable for use in contact with mineral acids and cannot therefore be used for accumulator lids.

TABLE OF ELECTRICAL PROPERTIES.

Composition.	Electrical breakdown at 20°C. volts per mil.	Surface resistivity. At 75% humidity, ohms per cm. sq.	Surface resistivity. After 24 hr. in water, ohms per cm. sq.	Volume resistivity. At 75% humidity, ohms per cm. cube.	Volume resistivity. After 24 hr. in water, ohms per cm. cube.	Dielectric constant.	Power factor (Tan δ-800 cycles).	Water absorption. 1 day.	Water absorption. 7 days.	Applications.	Examples.
Hydraulic cements with mineral fillers.	50–60	—	—	—	—	—	—	Very	high.	Arc-deflector plates and arc-chutes in circuit-breakers.	Paxbestos, Siluminite, Tenacit.
Lead borate and mica ...	375	$>10^{13}$	$>10^{13}$	—	—	8	0.015–0.020	Nil	Nil	Low-loss work at high temperatures, insulation in heating appliances.	Mycalex, Tenacit.
*Natural resin and mineral fillers.	375	5×10^{11}	10^{11}	—	—	5	0.1–0.2	0.1%	0.3%	Battery boxes, meter-cases, switch-plates, mouldings with heavy inserts.	Dagenite, Gummon, Telenduron, Cetec, Ebonestos.
Cellulose derivatives ...	400–500	10^{11}	5.10^{10}–10^{11}	10^{11}	5.10^{10}	5–7	0.02–0.03	0.4	2.0	Small parts, knobs and handles, lampshades, switch dollies, telephone cradles.	Cellomold, Bexoid, Crayonne, Erinofort, Trolit, A. T. Cellulose.
Rubber compositions ...	—	$>10^{13}$	$>10^{13}$	—	—	2.5–3.5	0.02–0.04	Nil	0.02	Scientific instruments, parts requiring good resistance to impact and moisture.	Belleroid, Keramot.
Polymerisation products: Vinyl	500	$>10^{13}$	$>10^{13}$	$>3\times10^{13}$	—	3	0.015	0.02	0.1	Extruded rods, tubes, etc., impact-resisting mouldings.	Alvar, Mipolam, Vinnapas.
Acrylic	500	$>10^{13}$	$>10^{13}$	$>1\times10^{13}$	—	3	0.03	0.1	0.3	Transparent effects, bright coloured parts.	Diakon, Pontalite.
Styrol	500	$>10^{13}$	$>10^{13}$	$>10^{13}$	$>10^{13}$	2.5	0.0002	Nil	0.07	Radio and high frequency work (low loss).	Trolitul, Victron, Waterlite, Resoglaz.
Condensation products: (a) Phenol-formaldehyde (including cresol-form): Wood filled... ...	300	10^{11}–10^{12}	10^{10}–5.10^{11}	10^{11}	10^{10}–10^{11}	5–7	0.04–0.02	0.1	0.3	Switches, plugs and sockets, lamp-holders, adaptors, meter-cases, magneto and coil parts, radio parts, domestic appliances.	Bakelite, Elo, Rockite, Mouldrite.
Mineral filled ...	200	10^{10}–10^{11}	10^{9}–10^{11}	10^{11}	10^{10}–10^{11}	7–20	0.2–1.0	0.03	0.12		
Fabric filled ...	250–300	10^{10}–10^{11}	10^{9}–10^{11}	10^{11}	10^{10}–10^{11}	4–7	0.22	0.1–0.3	0.4–1.0		
Cast resin	90–200	10^{13}	10^{11}–10^{12}	10^{13}–10^{14}	10^{13}–10^{14}	4–12	0.04–0.3	—	—	Mainly decorative	Catalin, Trolone, Marblette.
Laminated paper ...	200–850	10^{11}–10^{12}	10^{8}	10^{11}–10^{12}	—	5–6	0.003–0.100	0.1–0.5	0.25–0.80	Very wide use for punchings, stamping, etc., incorporated in switches, radio and telephone components.	Bakelite, Tufnol, Miocarta.
(b) Urea formaldehyde: Paper filled... ...	200–300	$>10^{13}$	10^{11}	10^{13}	10^{11}	5–6	0.03–0.04	0.10	0.50	Switches, plugs and sockets, adaptors, meter-cases, magneto and coil parts, etc., completely non-tracking—available in white and cream.	Beetle, Pollopas, Scarab, Mouldrite U.F., Mouldrite W.F.
Wood filled... ...	200–280	10^{13}	10^{11}	10^{13}	10^{11}	5–7	0.03–0.05	0.15	0.65		
Unfilled (moulded)...	—	10^{13}	10^{8}	—	—	—	—	0.45	2.0	For transparent effects ...	Beetle Transparent.
Laminated paper ...	—	—	—	—	—	—	—	0.40	1.8	Non-tracking laminated parts and decorative panels, printed labels and direction signs.	Beetle, Bakelite, Traffolyte.
(c) Glyptal resins ...	—	—	—	—	—	—	—	—	—	Incorporation in baking enamels.	Paralac, Rezyl, Alkydal, Beckacite.
Resin bonded mica	800	—	—	—	—	—	—	—	—	High temperature insulation	Micanite, Glyptanite.
Casein	100	5×10^{10}	10^{7}	10^{10}	10^{7}	7.5	0.14	1–2	6–8	Mainly for small parts which can be cut or machined.	Erinoid, Lactoid, Galalith, Egolith.
Porcelain	—	$>10^{13}$	$>10^{13}$	—	—	4.4	0.05	Nil	Nil	—	—
Steatite	—	$>10^{13}$	$>10^{13}$	—	—	6.4	0.0023	Nil	Nil	—	—

* The figures quoted for natural resin mineral fillers are for hot-moulded material with asbestos and mineral filler (type 7 of the V.D.I., 1935 classification).

Self-generating Photo-electric Cells. By G. Mainzer

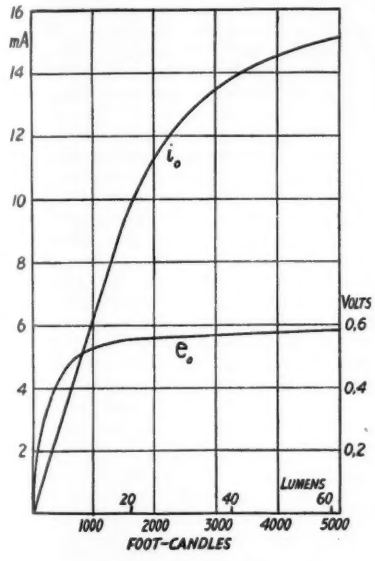
The possibilities of selenium

A study of the relationship between the intensity and colour value of light and cell output

As early as 1876 it was observed by Adams and Day that selenium when exposed to light shows electrical charges, but despite great efforts this effect could not be used for practical purposes. Between 1883 and 1885 Fritts made selenium photo-cells by the primitive method of pressing a translucent metal film of gold leaf on to a layer of crystalline selenium. These cells showed variations in their electrical resistance dependent upon the light intensity. With a small number of cells Fritts demonstrated that, when exposed to light, a very small current was generated. He was unable, however, to determine whether a certain cell was working as a "resistance type cell" or as a "self-generating type cell." This was left to chance. The output of the few cells he produced accidentally was therefore very low.

From 1928 to 1930 new investigations by Falkenthal showed that to increase the current output it was essential to bring the selenium and front electrode into intimate molecular and very close mechanical contact. The material for the translucent front electrode had to be evenly deposited. A heating process during this operation was avoided. This development resulted in the manufacture of photo-electric cells useful commercially.

The selenium photo-electric cell is based on the creation of a potential between conductor and selenium when one is deposited on the other in a layer thin enough for light to penetrate and strike the selenium. Radiant light energy is transformed into electrical energy, which may be used as a battery to drive current through an external circuit. The efficiency of this conversion varies with the spectral distribution of the incident light. In yellow-green light and at low values of illumination the current output of a cell attains 54 per cent. of the theoretical maximum, which is one electron per photon. This value refers to the total light energy incident upon the element. A lacquer covering and the translucent electrode film absorb 28 per cent. As 7 per cent. is reflected by the selenium surface, only 65 per cent. of the radiant energy is actually absorbed by the light sensitive layer. Taking this into consideration, the current output is therefore 83 per cent. of the possible maximum. Marked improvements in sensitivity and output are, therefore, not to be expected.



Short-circuit current (i_o) and open-circuit voltage (e_o) of a photo-electric element

The photo-electric cell, as now used commercially, consists of a metal disc or plate with a layer of selenium compound on one side. Over this are two further layers: first, a transparent conductive film in finely divided form, at the boundary surface of which against the selenium the radiant energy is transformed into electrical energy, and, secondly, a conductive film acting as an electrode. A protective transparent varnish finally covers the surface with the exception of a narrow ring parallel to the edges, where a metallic collector ring is sprayed on to form the negative terminal. The untreated back of the disc forms the positive terminal. Such elements, unlike the earlier resistance-type selenium cells, are self-generating. The cells described are inherently free from time lag, which has been a serious handicap with the resistance type.

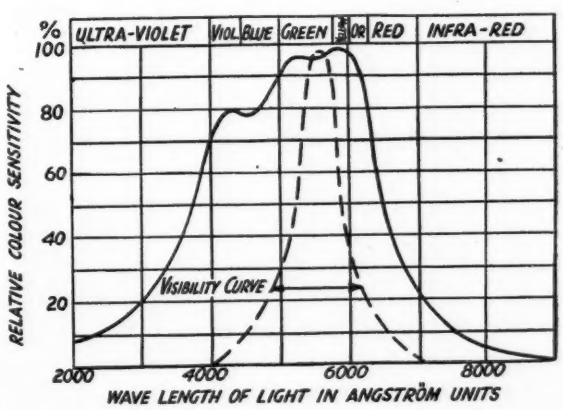
If the terminals of a photo-electric cell are connected to a galvanometer or milliameter, the instrument will show a deflection immediately the element is exposed to light. A sufficiently sensitive magnetic relay can be operated direct from the cell without using any other source of current.

Such photo-cells are not subject to internal physical or chemical reactions. Short-circuiting, even under illumination, causes no harm to the cell, provided the temperature is kept below the safety limit. The life of a good cell is, therefore, practically unlimited. Tests have shown that during nine months' continuous exposure to sunlight a loss in output of 15 per cent. only can be measured. The safety limit is about 216 deg. C.

Under conditions prevailing in practical operation the current output decreases with rising temperature at about 0.1 per cent. per deg. C. This effect can be reduced by using the lowest possible value of illumination with moderate resistance in the external circuit. At very low resistances the temperature coefficient may even become zero or negative, *i.e.*, the output may be found to increase with rising temperature. The explanation of this is that thermal changes do not affect the photo current proper, but only the internal shunt resistance which decreases with rising temperature. The influence of the internal shunt resistance is considerable only at high values of illumination and at high external resistances. Measurements with high external resistance are therefore only advisable where the temperature is fairly constant.

The effect of temperature changes upon the distribution of the sensitivity over the spectral range is negligible for most practical purposes. The open circuit voltage of a photo cell is independent of its active area, being approximately 0.4 V per 100 foot-candles, but with strong illumination, as in direct sunlight, it approaches a value of 0.6 V. Fig. 1 shows the voltage e_o across the terminals of an element as a function of the illumination. The active area of the element was 1.76 sq. in.

The current output curves obtained with low external resistance differ widely in character from those obtained with high resistance. In fig. 1 the external current i_o for negligible resistance in the external circuit is plotted against the illumination. It shows that for lower illumination the short circuit follows a straight line. At higher values the curve rises more gradually with increasing light intensity. This deviation is caused by a shunting effect within the element which increases with the illumination and finally becomes dominant with very strong light. Within the range of low light sensitivities the short-circuit current is not only proportional to the illumination but also to the active area of the cell. Thus the short-circuit current, per unit of illumination and per unit of area, is a constant applying to all sizes of cells at low levels of illumination, *viz.*, 3.6 μA per foot-candle per sq. in.



Light wave-lengths and relative colour sensitivity

The calculation of the short circuit for various sizes of cells is therefore as follows: a 45-mm. diameter cell has an active surface of 1.76 sq. in. which, multiplied by 3.6 ft.-candles per sq. in., gives 6.3 μA per ft.-candle. As the short-circuit current is proportional to the illumination as well as to the active area at low light intensities, a certain luminous flux produces the same short-circuit current whether it is concentrated on the surface of a small element or whether

it is distributed over the surface of a large element. The short-circuit current per unit of luminous flux (lumen) is therefore also a constant for all sizes of cells at low levels of illumination, amounting to 480 μA per lumen.

In direct sunlight (about 15,000 foot-candles) the short-circuit current of the above-mentioned cell is 10 to 20 mA. In the range of these high intensities there is a deviation from the linear relation between current output and active area, larger elements showing somewhat less current than would be expected. Nevertheless fig. 1 can be taken to give an approximate value of the short-circuit current.

The resistance is of considerable importance. The relation between the current i, the illumination L, the active area A and the resistance r, is given in the following equation: $i = cLA/l + r_e + r_s + r_t/r_i$, wherein c is a constant indicating the total photo-current per sq. in. of exposed surface and per ft.-candle of illumination. The resistance of the semi-conductor r_s and of the electrode film r_t is of the order of 10-100 ohms; r_i is the internal shunt resistance of the element. The two resistances r_s and r_t act in series with the resistance in the external circuit, therefore only a limited advantage is to be expected from the use of measuring instruments of low internal resistance; r_t is the total resistance encountered by the current in passing from the collector ring through the extremely thin electrode film to the different parts of the active surface. To keep this low the length of the current paths must be a minimum.

With elements where it may be desirable from the point of view of design to use a metal collector extending only part of the way along the edge, the paths of the current are lengthened. Such elements are therefore less advantageous with regard to the current output. The same factor also limits the gain to be obtained from increasing the active surface of the elements and is responsible for the lower current at higher light intensity from larger elements than would be expected in view of their active surface.

For many practical purposes the resistances r_s and r_t can be neglected. The internal shunt resistance r_i depends widely upon the illumination. For instance, the resistance of the 45-mm. diameter cell in the dark amounts to about 140,000 ohms, but drops to approximately 1,200 ohms at 100 ft.-candles, and approaches a minimum value of about 60 ohms at very high light intensity. The corresponding internal shunt resistance of other sizes can be computed from these figures inasmuch as this resistance is inversely proportional to the active surface.

Some measurements were made recently by Mr. R. M. Holmes (*Electronics*, April, 1937) with a 300-W lamp, operated at a colour temperature of 3,230 deg. Kelvin. The value of colour temperature was based on information given by the General Electric Co. of America. A cell of the type manufactured by the Electrocell concern was used with a very small external resistance. The output was found to be 484 μA per lumen, and with 200 ohms external resistance the output was 466 μA per lumen. Both values were in the straight line part of the characteristic. The author describes these outputs as remarkably high. He says the same with regard to the potential difference at the terminals of the cell on open circuit. Even with the small illumination used from the 300-W lamp (0.0081 lumen on the cell) he found the potential difference to have the remarkably high value of 0.142 V. An automobile lamp, rated 21 c.p. at a distance of 25 ft., produced a potential difference of 20 mV, the illumination on the cell in this case being 0.035 ft.-candle.

The sensitivity is different in various parts of the spectrum. The curve of the relative colour sensitivity is shown in fig. 2 to extend far into the ultra violet. By using filters the relative sensitivity of the cells can be made to coincide with that of the human eye. The sensitivity over the surface of the element is distributed equally. The output per unit of area is, however, slightly higher near the collector ring, as the influence of the resistance in the path of the current is, of course, smaller there. A certain luminous flux produces practically the same amount of current whether it is concentrated on a small part of the surface, or whether it is distributed over the total active area, inasmuch as the current output is proportional to the illumination as well as to the illuminated area. In this case the shunt resistance in the unexposed parts is high enough to by-pass only a negligible fraction of the total photo-current.

If, however, the concentration of the luminous flux results in a high value of illumination, the shunt resistance of the exposed parts decreases, and the current output drops accordingly. In this case equal distribution of the luminous flux over the whole active area of the element is usually preferable from the point of view of high current output and sensitivity. This equal distribution also has the effect of keeping the illumination at the lowest possible value, which tends to minimise the influence of temperature change.

For all ordinary measuring or relay purposes the elements have no measurable time lag. The current output declines when the incident light fluctuates at high frequency. At 6,000 cycles their electrical output is about 40 per cent. This fact is caused mainly by the capacity of the elements, which can be reduced by operating several elements in series and by using a suitable inductive reactance in the circuit. The cells are subject to a "fatigue" effect, arising from a change of resistance of the selenium layer. At low and medium values of illumination this effect can be kept within very narrow limits by using low resistances in the external circuit. It can be further minimised with only a slight reduction in sensitivity by using a filter, the absorption of which lies at around 7,000 A.U.

Good photo-electric cells are moisture proof for most practical purposes; only in air containing salt or acid are special precautions required. Compared with photo tubes their mechanical ruggedness is a special advantage. These qualities of the self-generating photo-electric cell have opened new fields for its application in all kinds of measurement.

A knowledge of the properties of the photo-electric cell may induce designers to seek further possibilities for its use in practical electrical development.

Television Experience

MEMBERS of the London Branch of the Association of Mining Electrical Engineers were the guests of the General Electric Co., Ltd., on January 11th when Mr. H. J. Shaw addressed them, with the aid of demonstrations, on the non-technical aspects of television.

The speaker began by treating the subject historically, and explained how under normal conditions television reception could usually be guaranteed at any point within a 30 miles radius. But there were many instances of reception outside the normal service area and his company had installed television receivers in customers' houses situated some considerable distance outside the 30-mile limit, e.g., at Brighton and Ipswich. Several sets situated at distances of 40 and 45 miles from the transmitting aerial at Alexandra Palace were working normally and giving satisfaction to their owners.

Dealing with some of the conclusions to be drawn from a year's experience in television receiver manufacture and sale, he said that the experiment should be taken seriously. Television, in England at least, had come to stay and must be the ultimate form of the domestic application of radio transmission. The comment sometimes heard that the present prices of television sets were too high and were bound to be reduced sooner or later was not true. The enormous number of components used, and the high degree of engineering skill required to design and persuade such a collection of apparatus to work according to plan indicated the impossibility of producing such receivers at very low prices. It was well to bear in mind that present-day television receivers were not produced economically; they could not be sold even at present prices were they not subsidised by their manufacturers.

Finally, Mr. Shaw said that the extension of broadcasting hours should assist television sales, and he also referred to a proposal which had been made to extend the range of stations by the erection of other transmitters fed from London by land line. Replying to questions, he said that cathode-ray tubes installed in receivers 12 months ago, or more, were still functioning satisfactorily, and no cases had been found of the tubes themselves failing. His company had instituted a scheme whereby replacement tubes were available on payment of a small sum, but up to the moment it had not had to make use of it.

It was not possible to damage a cathode-ray tube by mishandling the controls of the receiver; the screen of the tube could, however, be damaged by burning, if the spot were allowed to remain stationary for any length of time. But the circuit of the receivers had been so arranged as to prevent this.

The power consumed by sets was 240 W or slightly less. Television and sound could be received on the same aerial; the input circuits were arranged to separate the sound and vision signals and to deliver them to the appropriate sections of the receiver. The highest voltage obtained was just over 3,400 V. The receivers were made quite safe by means of an electrical interlock and the back of a set could not be removed without breaking the mains circuit. Work was proceeding in connection with reproduction in natural colours; it was not yet out of the laboratory stage, but it would come eventually.

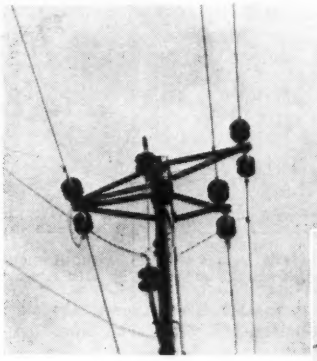
Wood Pole Construction.

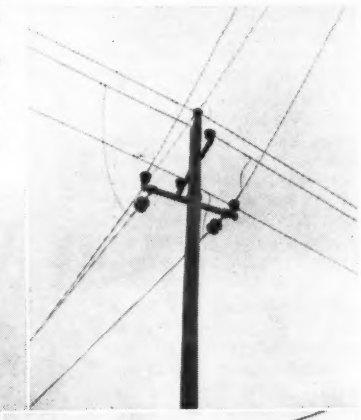
Its application to high-voltage rural distribution

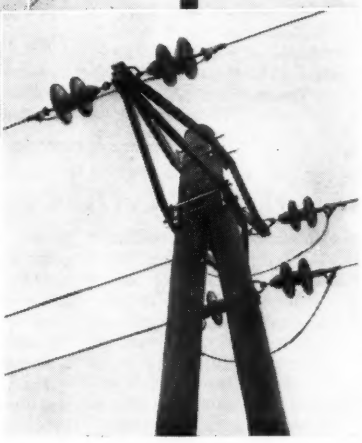
By J. C. Costello, B.Sc.

DESPITE the advent of various competitors, wood-pole construction is still practically universally accepted as the best and most economical for low- and medium-voltage overhead lines. For the higher distribution voltages (33, 38, and 44 kV) much diversity of opinion exists, many authorities, particularly where wayleave difficulties are acute, preferring long spans with steel masts.

However, even where wayleaves are costly, the wood-pole line is generally more economic in first cost, and also in annual maintenance costs. Further, the consensus of opinion seems to be that it is more reliable in operation. In the system with which I am associated* this is very definitely the case. About half of the total length of 38-kV line is wood-pole and half steel-mast; on the latter the number of faults has been found to be no less than four times the number on the wood-pole lines, the damage during blizzards being very much more severe. This figure relates to lines of the two insulator disc type; when the number of discs per string on the steel-pole lines was later increased to three the performance was only about equal to that of the wood-pole lines. In recent years methods of construction of lines and pole sub-stations have received considerable attention, with a corresponding improvement. However, standardisation is yet far from being attained, a wide diversity of methods being still employed. The process of development, selection and elimination must therefore continue, attention being paid not only to cost and technical satisfactoriness, but also to the unduly neglected matter of appearance.







Figs. 1 (top right), a four-way branch point on a 10-kV line. 2 (bottom right), typical headgear of a 38-kV strain mast; and 2a (above), a similar mast with a branch-off

The present article offers for comparison with English practice some examples on the Continent and in the Irish Free State (where design has evolved in large part from Continental prototypes).

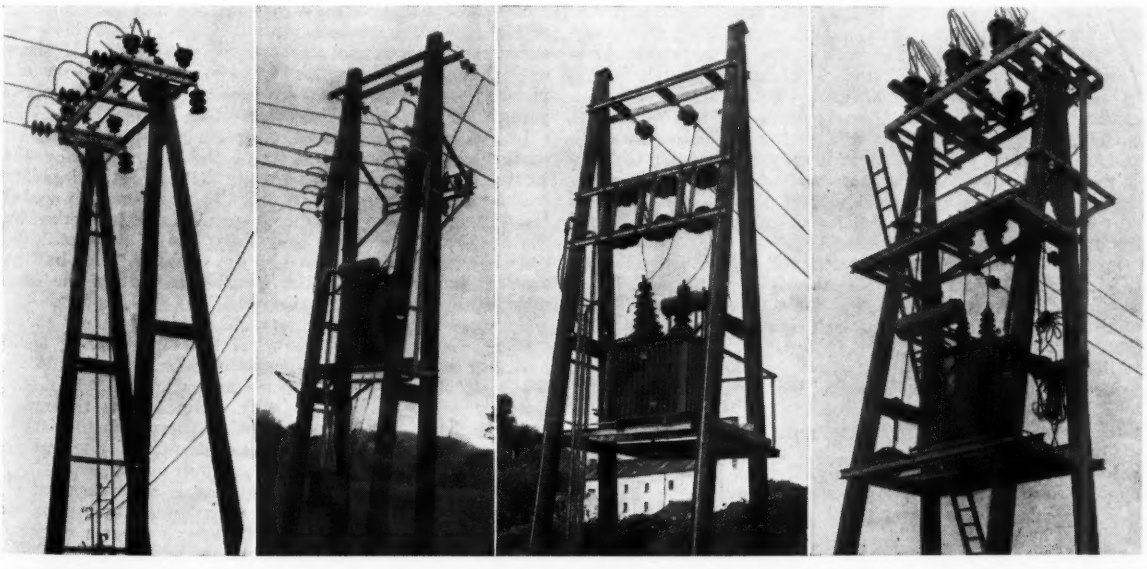
Fig. 1 shows a four-way branch point on a 10-kV line. The cross-arm is attached by a U-bolt without drilling the pole; the upper lyre-shaped member may be attached by straps without drilling the pole, or by coach-screws or two through-bolts. This "lyre" headgear is generally used for 10-kV lines. It is bent to shape out of a single length of channel and gives an equilateral spacing of about 3 ft. 3 in. Its simplicity, cheapness, strength, and ease of erection are obvious. Birdguards are not used as the system neutral is unearthed; a bird pecking at the line from a perch on the horizontal portion of the lyre merely results in a momentary displacement of the system neutral, accompanying the passing of the bird.

Typical headgear of a 38-kV strain mast, consisting of two cross-arms gusseted together at one side so as to form, with the mast, a triangulated structure with its sides produced, is shown in fig. 2. Again, it will be noticed that the pole is not drilled.

In the case of single poles used as intermediate poles a similar headgear is used; each cross-arm, however, is a single channel (the two passing on different sides of the pole). Fig. 2a shows a similar mast with a branch-off.

On both 10- and 38-kV lines A-masts are used in angle and terminal positions in preference to H-masts and stays. Where a single A-mast would not be sufficiently strong steel masts are generally used, but occasionally double A-masts are employed, *e.g.*, in terminal positions where an air-break switch is to be put in the line. Fig. 3 shows an example; the triple-pole earthing contacts with separate operating mechanism will be noted.

Turning to pole sub-stations, fig. 4 shows a 10-kV, 30-kVA, three-phase sub-station without switch or fuses on the high-voltage side. The low-voltage fuses are housed in the small box at the bottom, to and from which the leads are brought in g.b. tubing. The station mast also acts as the line terminal



Figs. 3 (left), a double A-mast; 6, a 75-kVA, 10-kV pole station with a triple-pole high-voltage switch-fuse; 7 and 8, examples of 38-kV pole sub-station construction

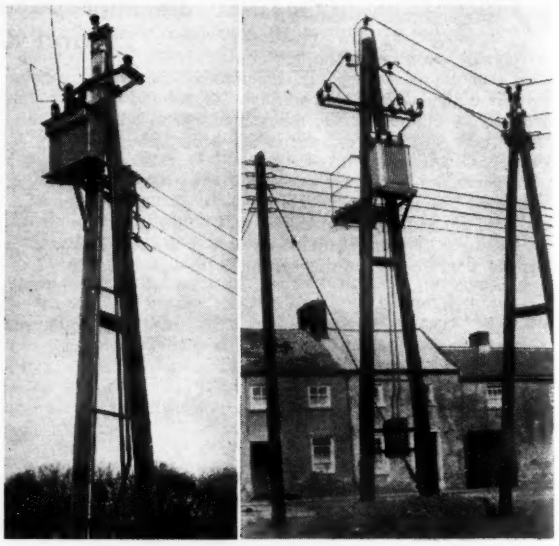
* Mr. Costello is engineer-in-charge of the 38-kV section of the Irish Electricity Supply Board's Design Dept.

mast. An identical construction is used for single-phase sub-stations of 10, 20 and 30 kVA.

Fig. 5 illustrates a 50-kVA, three-phase, 10-kV sub-station with fuses, but no switch, on the high-voltage side. The station mast in this design cannot be used as a line terminal mast. In fig. 6 is shown a 75-kVA, 10-kV pole station with triple-pole high-voltage switch-fuse. The switch-fuse is operated from the ground by a double pull-wire arrangement which can be padlocked. Barbed wire climbing guards are provided owing to the relatively low level at which the transformer is mounted. Transformers up to 200 kVA are mounted on this type of station.

Figs. 7 and 8 show examples of 38-kV pole sub-station construction. In fig. 7 the sub-station is for direct transformation from 38 kV (380/220 V) and has a 100-kVA three-phase transformer, with carbon tetrachloride fuses, but no switch, on the high-voltage side. Low-voltage fuses and meter are housed in the boxes at the bottom; the outgoing leads for two low-voltage lines (up to four may be brought out) are shown taken up in g.b. tubing. The low-voltage lines were not erected when the photograph was taken. A platform is provided for the operator's use when replacing 38-kV fuses, which is done by means of screw fuse tongs.

Fig. 8 shows a 200-kVA, 38/10-kV pole station just being completed. A 38-kV air-break switch is provided as well as fuses. The arrangement of the fuses may be noted. The fuse holders are of the type having the insulators at 45 deg. to the base which is intended to be vertical. Here, however, the base is mounted sloping back at 45 deg. so that the insulators are vertical and one is well behind the other, thus making the leads from the switch sufficiently short. The fuses are vertical and within easy reach of the "catwalk," or narrow platform, which is provided for the operator. A hand-rail is fitted on which he can lean. The switch, the operating shaft of which is visible on the side, must be opened from the ground before mounting the platform. In this sub-station, as also in that shown in fig. 7, the station structure serves as terminal mast for the 38-kV line.



Figs. 4 (left), a sub-station without switch or fuses on the high-voltage side and 5, with fuses but no switch

The Morse Code. By H. M. Sayers

THE Morse telegraph apparatus was shown by the inventor to a group of friends in 1836; it was publicly demonstrated at the Smithsonian Institution, Washington, on January 24th, 1838, and commercially used in 1844. It is fitting to notice the centenary of the public showing of a notable invention.

The Morse apparatus was electrically as simple as possible. A transmitting "key," putting the line to the receiving instrument while at rest, and to one pole of an earthed battery when depressed, and a receiving electro-magnet with an armature mounted on a rocking lever and pulled away from the magnet poles by a spring, and adjustable stops above and below the rocking lever. The armature lever therefore reproduced the movements of the distant key. Morse mounted a stylus on the armature lever and arranged a train of clock-work to draw a paper "slip" past the stylus, so that the slip had a raised line embossed upon it for so long as the armature was in the attracted position.

Thus the key and armature had two elementary positions "spacing" and "marking" from which an alphabet had to be devised. Morse had the brilliantly simple idea that two distinct durations or lengths of mark, the "dot" and "dash," would give enough combinations to include all the letters and digits necessary for communications. The dot being taken as the unit of duration, the dash was equal to three dots. Combinations of no more than four of these two elements provided the 26 symbols needed for the alphabet and left a few four-element signs for punctuation.

Spacing intervals had to be just as well defined as marks: the intervals between the marks of each character sign, between each letter of a word, and between each word. The minimum between the marks of each character is the time of the key passing from the marking position (front contact) to the spacing position (back contact) and descending again to the marking position; the interval between letters is equal to a dot, and between words equal to at least a dash. The three spacing elements are just as important to legibility as the marking elements. "Keying" is not just tapping the key, the knob must be held firmly, the spacing movement must be controlled, not left to the retractile spring.

It was found in practice that this dot-dash alphabet was easily learned, a few weeks' practice enabling the average learner to read nearly as fast as he could write legibly. Sending required rather more practice; young learners could usually key legibly at up to 15 words per minute after three months' practice, old hands got up to 40 or more words per minute. In keying one makes the pattern or rhythm which is associated with the letter as read; sound and touch co-operate to produce that rhythm. The first thing a skilled Morse operator does on sitting down to an instrument is to adjust the play of the key and the strength of the retractile spring to suit his speed and style. It may have been a surprise to find that Morse working speed could surpass longhand writing speed. A greater surprise, probably, was the fact that the operators could read by the sound of the armature lever striking the top and bottom stops as well as, or better than, by looking at the embossed slip which, incidentally, required a fairly good light.

This Morse sound reading is rather a curious thing. It is not reading by the duration of the marking signals and the spacing intervals as occurs with the buzzer receivers used in radio-telegraphy, but by the pattern made by the time intervals between the sounds made by the lever meeting the bottom stop at the beginning and the top stop at the end of a mark. The two sounds are naturally different, the armature moves down under an increasing force and up under a decreasing force.

The consequence of this experience was that the embossing printer had but a short life; in the U.S.A. at least the Morse sounder became the almost universal instrument. If Morse could have foreseen the facility of sound reading he would probably not have burdened his receiver with clock train and paper reel.

In the 1850's an Austrian engineer put an inking wheel on the armature lever instead of the stylus, making the Morse "ink-writer." This greatly improved the legibility and permanency of the slip record. The inker magnet needed less power than that of the embosser, it could be worked by the line current on fairly long lines, and it eliminated the relay and local battery needed by the embosser for all but the shortest lines. The inkwriter soon became one of the most widely used instruments in Europe.

European telegraph administrations did not favour sound reading, they valued the record of the slip—to bring home errors to the culprits, or perhaps for other purposes. After the Post Office took over the telegraphs in 1870 official distaste for sound reading gradually diminished as the result of trials on some selected lines which proved it to yield a higher working speed with at least equal reliability to reading from slip.

The Wheatstone automatic apparatus is a development of the Morse. The key is mechanically controlled by a punched slip, driven by a clock-train; and the receiver has a sensitive polarised movement yielding a working speed which the P.O. engineers pushed up to 400 words per minute (usually the line characteristics limit the working speed). Wheatstone working did excellent service in the British Post Office telegraphs for over half a century.

The Morse code was adopted for the single needle, the cable mirror and syphon recorder alphabets by making the left and right deflections of the needle top correspond to the dot and dash of the printer or sounder. The standardisation

Current Rating of Cables

New tables based on E.R.A. investigations

TWO papers were presented at the January 19th meeting of the Transmission Section of the Institution of Electrical Engineers in London, both of them in the form of reports (Ref. F/T.117 and F/T.115) on investigations carried out by the Electrical Research Association.

The first paper by Dr. S. Whitehead and Mr. E. E. Hutchings, points out that current-carrying tables published by E.R.A. have hitherto covered single-core and belted multi-core cables when loaded with d.c., although a.c. was nominally covered in addition. The accumulation of considerable new data has since formed the basis for new rating tables.

For example, the increased rating of multi-core cables when employed unarmoured amounts to about 3 per cent. for concentric and triple-concentric cables, and also, if used for d.c., for other cables up to 1.5 kV. The same figure of 3 per cent. may be used for all cables up to 0.3 sq. in. For multi-core cables of sizes above 0.3 sq. in. with a.c., losses in the armouring become appreciable, such that the increase for unarmoured relative to armoured cables, for sizes from 0.3 to 0.5 sq. in., is 4 per cent. for twin- or screened multi-core cables and 5 per cent. for multi-core belted cables. For sizes 0.5 to 0.75 sq. in. the increases are 5 and 7 per cent. respectively. Above 0.75 sq. in. the figures are 6 and 10 per cent. respectively.

The rating of cables designed for systems with the centre point not earthed are 2 per cent. (3 kV), 3 per cent. (6 kV), or 4 per cent. (10 kV) less than for cables for earthed systems.

For single-core cables the effect of additional a.c. losses becomes considerable for the larger sizes of cable. Increased thickness of insulation has not a very great effect, the reduction for 20-kV cables being mainly due to the reduction in permissible temperature-rise from 55 to 50 deg. C. With d.c. concentric and twin-circular conductor cables have about the same rating, but twin-shaped conductor cables are some 5 per cent. superior. With 3-core cables shaping is of less advantage as regards rating. Screened and S.L. type cables give about the same rating, the better thermal dissipation in the latter case being off-set by the increased sheath losses due to circulating currents.

Belted cables have a lower permissible temperature-rise than non-belted cables, and therefore a lower rating. The difference for 20 kV is 10 deg. C., which gives 20-kV belted cables a much lower rating. Thickness of insulation does not, of itself, have much effect as is shown by the small difference between screened 10-kV and belted 1-kV cables.

The superiority in rating of single-core over multi-core cables is comparatively small. The improved thermal dissipation is partly offset by the sheath losses, particularly with large cables. If wide separations for phase isolation with single-core cables were required, special methods of sheath binding to reduce losses would become desirable or necessary.

For 3-core armoured cables in a 9-way stoneware duct the values are of the order of 0.5 times those of single cables laid direct, which corresponds roughly to the grouping factor of 0.53 for cables at 6-in. spacing. For armoured cables, which have the same temperature-rise, the ratings in ducts will not differ greatly from equivalent groups of cables laid direct. With several duct-ways the type of cable is less important and the ratings are not much affected by voltage, shaped or circular conductors, belted, screened, or S.L. type. The ratings of armoured cables are of course reduced, corresponding to the much lower maximum temperature of 50 deg. C. for such cables when drawn into ducts.

The ratings of cables in air with an ambient temperature of 25 deg. C., the temperature-rise of the cables selected being 45 deg. C., corresponding to a maximum temperature of 70 deg. C., are some 10 to 15 per cent. greater than those of cables laid direct in the ground, owing to the better thermal dissipation in spite of the lower temperature-rise. The internal thermal characteristics are of more importance, such that we find 3-kV cables have a slightly higher rating than 1-kV cables owing to the lower thermal resistivity of the insulation; but taking a wider range of voltage, there is little change with voltage apart from the lower maximum temperature with 10- and 20-kV cables. The effect of features such as the use of shaped cores, belt insulation, armoured or unarmoured, will be of the same order as for cables laid direct.

In general, the main differences between the U.S.A. and E.R.A. ratings can be ascribed to differences in the maximum and ambient temperatures and assumptions made as to the basic conditions of installation.

The authors also indicate means of calculating the ratings of cables installed in non-standard ways. There are three appendices to their paper. One deals with intermittent rating; another with the effects due to finite length of the system; and the third with the theory of armour losses, in which connection the use of non-magnetic steel is said to be worthy of consideration.

In Buildings and Ships

The second paper, by the same authors jointly with Mr. H. C. Booth, contains an account of investigations with a.c. instead of d.c. and with cables installed in manners not previously taken into account. On these investigations were based much of the revision and, in particular, the new rating and voltage-drop tables, with Appendix 5, of the Tenth Edition of the I.E.E. Regulations for the Electrical Equipment of Buildings. The revision of the relevant portions of the next edition of the Regulations for the Electrical Equipment of Ships will also be based on these investigations. This work was carried out partly at the National Physical Laboratory and partly at the E.R.A. auxiliary laboratory.

The results show that the reduction in current-carrying capacity due to skin effect and sheath losses is only serious in cables of 0.5 sq. in. conductor section and above. The increase in current rating due to better cooling conditions when cables are spaced farther apart may be partially or wholly counterbalanced in lead-covered cables by increase in sheath losses. In the case of bare copper rods run vertically, the temperature of which may be higher than that of insulated cables, it was found that excessive heating of v.i.r. cables connected to the rods occurred near the joints.

When cables carrying a.c. are run close to a steel plate the impedance is increased, and in some cases the effect on the voltage drop may be sufficient to necessitate reducing the current rating of the cable below that based on the permissible temperature-rise. Also, in the case of a reinforced-concrete building, steelwork may be so heated owing to heavy currents in large cables as to cause serious expansion.

The original figures have been confirmed as an average for conduit, casing, duct, or troughing systems of wiring and also for surface or "bunched and open" systems.

Where more than two cables are so run a reduction factor must be applied according to the number. These factors do not vary greatly as between the different systems so that it is possible to adopt, as in the Tenth Edition of the Wiring Regulations, general average reduction factors for 4, 6, and 10 cables (or their equivalent), *viz.*, 80, 70, and 60 per cent. respectively. The reduction factor for six cables may also be applied to obtain the current rating of one 3- or 4-core cable from that of two single-core cables of the same size.

For the sizes considered, namely, up to 0.5 sq. in. for 2 or 4 cables, up to 0.25 sq. in. for 6 cables, and up to 0.15 sq. in. for 10 cables, the d.c. and balanced-a.c. ratings may be taken as the same. With steel conduits a lack of balance in an a.c. system may cause a material reduction in the carrying capacity.

The carrying capacity based on temperature-rise may be deduced theoretically, and is in reasonable agreement with experiment; but, owing to variation in conditions, it is unwise to rely upon theoretical results. The impedance or voltage-drop is in satisfactory agreement with theory in the absence of ferrous material and also in its presence, subject to certain assumptions.

Bare copper rods may be run at a higher temperature than insulated cables, and have higher ratings. If v.i.r. cables are connected thereto, excessive heating of the insulation need only be anticipated within a short distance of the joint.

The I.E.E. Wiring Regulations allow a margin of safety as regards ambient temperature which would cover the variation in temperature in vertical chases. The loss of this margin of

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The Morse Code (*Continued from previous page*)

by international agreement gave telegraphists everywhere a common code for the Roman alphabet, including some peculiarities of certain languages. It is widely used in cable and radio-telegraph systems as well as on some long land lines in various countries. It is neither obsolete nor obsolescent. It has given very fine service for nearly a century. Hence the daily Press announcements of the "End of the Morse System" couched in terms suggesting that it was a relic of barbarism from which the British telegraphs were now happily freed seem to be quite inappropriate.

Morse is said to have invented a plough and accessories for laying telegraph wires underground, but it struck him that the air was a better insulator than any he was likely to find available for buried wires, and free, and so he adopted the pole line. It would be interesting to know whether he was the pioneer in this direction. When, where, and by whom, was the first pole line built in this country?

Meetings and Discussions

The advance in glassmaking technique, particularly from the lighting point of view, was dealt with by a number of speakers last week at the Society of Glass Technology. Commander F. T. Hewson addressed an informal meeting of the I.E.E. on electricity in the catering industry—a field in which he is well known—on January 10th. The remarkable progress made by the synchronous clock was the subject of a contribution to a discussion at the British Horological Institute last week. At an E.P.E.A. meeting on January 11th Professor W. M. Thornton spoke on a little-known subject—Poynting's law

Modern Glassmaking

THE twenty-first anniversary celebrations of the SOCIETY OF GLASS TECHNOLOGY included a series of five lectures which were delivered in London on January 12th. The president of the Society, Prof. W. E. S. Turner, outlined the progress made in the manufacture in this country of chemical and scientific glassware since the war, prior to which Germany and Czechoslovakia were the chief sources of supply. For the manufacture of simple articles semi-automatic machines were now in use in Great Britain. The Danner tube drawing machine, which had been used for many years in England by the big electric lamp companies, had recently been making glass tubing for scientific ware with results which had consolidated the position in this country. The quantity obtainable, and the precision of diameter and thickness were far in advance of those of hand-made material.

Pipe lines of glass were now coming into use for industrial purposes. Large glass mercury rectifiers, in which the graphite anodes might reach a temperature as high as 800 deg. C., were now used for power supply. All the power for running the electrified railway line from Manchester to Bury passed through such glass apparatus. Special resistant glasses were required for the new metallic vapour lamps of high power for lighting arterial roads, and for television screens. The Professor showed in action an electric radiator obtained by spraying a thin grid of aluminium on a panel of toughened glass.

Mr. R. McGrath, the architect, lectured on "building with glass," mentioning the availability of diffusing glasses for all forms of artificial lighting and other types which freely admitted the health-giving ultra-violet radiations of daylight.

Mr. B. D. Dudding dealt with the efforts of lighting engineers towards reducing the cost of providing improved lighting by developing illuminants of greater intrinsic efficiency and producing apparatus to distribute the light in the manner most suited to the needs of the particular problem concerned. He said that the glass used in a mercury vapour lamp operated at 600 deg. C., and at that temperature the electrical resistance of the glass was 300,000 times that of the straight soda lime silica glasses used in 1916. In fact the electrical resistance of these new glasses at such high temperatures was greater than that of fired quartz. Now glasses entirely free from silica for use in metallic vapour lamps resisted for hours the blackening that was developed by a normal soda lime silica glass in a matter of minutes.

To obtain diffusion so that high intensity light sources would not cause discomfort bulbs were now frosted internally in such a way as to cause minimum reduction of strength. The loss of light was only one per cent. Alternatively, opal bulbs or shades had been so improved that the very serious loss of light formerly incurred had been reduced to less than 10 per cent. of that emitted by the illuminant. This had resulted entirely from investigation of the conditions causing scattering of the light in the glass by the opalising material and of the effect of melting conditions leading to realisation of optimum diffusion with minimum absorption. Modern opals were made as 2-, 3-, and 4-ply glasses, the opal in the 3-ply glass being covered on either side with clear glass.

Lighting fittings embodying wedge-shaped portions to deflect the light had been made to an accuracy of two thousandths of an inch in the dimensions of the glass prisms concerned. Silvered mirror projectors for floodlighting aeroplane landing grounds, had a candle power of 1½ millions with only 9 kW energy consumption. In the case of shop window lights, corrugating the shade had removed a tendency to produce images of the lamp filament as bright streaks across the goods displayed. Good fittings of this type concentrated 70 per cent. of the light emitted on to the working plane when this was desired.

Much progress had been made in decorative lighting ware in the last twenty years, and now it was possible to buy at reasonable prices British-made lighting ware having claims to beauty. Coloured opal bulbs with a minimum loss of light were now available. Since 1916 office lighting had risen from one to 10 ft.-candles, while tube railway carriage lighting now approached 30 ft.-candles.

Catering Requirements

AT the informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 10th a discussion on electricity in the catering industry was opened by Commander F. T. Hewson, who approached the subject from the point of view of the *chef de cuisine*. He said that there was still a vast amount of prejudice against electricity as a cooking medium, especially among the older generation of chefs, but that the younger men were more readily converted.

He divided commercial cooking into four classes, each of which required its own technique and equipment. The procedure in hospitals and canteens was similar as the food in both cases was cooked in bulk, but in hospitals the distribution problem involved the use of "hot" trollies. It was usually the practice to install a central range, together with the necessary auxiliaries, such as stock-pot stands, bains marie, salamanders, hot cupboards, &c. The range had been developed rather on the lines of the coal range, and was built up in units according to requirements. Any number of hobs could be fitted, some of which were known as the "taper heat" and some as multiplate hobs. The former were fitted with a large plate which remained red in the centre and small elements in the corners so as to control the rate of cooking by means of the position of the pot rather than having to rely on switches. It was hoped that in time manufacturers would be able so to increase the loading of the centre plates that the greatest objection to electric cooking would be overcome, namely, comparatively slow boiling.

The ovens were usually of the shallow type and were now almost always thermostatically controlled, the idea being not so much to maintain a constant temperature, but to have heat available when wanted. There was not time in the kitchen doing a fast *à la carte* service to bother about switches. The pastry kitchen was usually a separate entity and responsible for all sweets, ices, pastries, &c., and in this department electricity held its own in the form of the pastry oven which very few of even the most violently anti-electric chefs had anything to complain about. For the larger cafés the same practice, modified, was usually observed as in restaurants, but in the smaller ones the equipment was very much smaller. Milk bars were a comparatively recent development and electricity had invaded this domain, but very little cooking was done.

It was difficult to forecast consumption accurately, but for installations over 20 kW the consumptions per kW of connected load worked out on an average as follows:—Canteen and staff restaurants, 590 kWh; public houses, 820 kWh; service flats, 1,210 kWh; hotels, clubs, and similar establishments, 1,500 kWh.

It was difficult to give any definite method of approach from the sales point of view so far as the chef was concerned, but such things as kilowatts should be avoided so far as possible, as usually he had no knowledge whatever of this side and was only interested in the performance of the equipment and the results obtained therefrom. Therefore every sales-

Current Rating of Cables (*Continued from previous page*)

safety cannot generally be recommended, and a reduction in carrying capacity may have to be considered on this account. The use of intermediate stoppings, as prescribed by some authorities, is not necessarily a cure.

The carrying capacity of cables in conduits, chases, ducts, on walls, &c., may be expressed approximately as $kA^{0.5}$ amperes, where A is the cross-section in sq. in. and k is a factor depending on the method of installation and the number and nature of the cables.

The current rating corresponding to a core temperature-rise θ may be calculated from the current which will produce any other core temperature-rise θ_o, by multiplying the latter by a factor $(\theta/\theta_o)n$. For cables of less than 0.1 sq. in. installed under any condition $n=0.5$, while for larger cables n may be taken as 0.54, provided that θ/θ_o is not less than 0.56 nor greater than 1.8.

man of electric cooking equipment should have at least a rudimentary knowledge of cooking and of what his apparatus was capable of doing.

The Clock of the Future

THE respective merits of spring-wound and electric clocks were discussed at the BRITISH HOROLOGICAL INSTITUTE in London on January 12th. The case for the synchronous mains-driven electric timekeeper was put by Mr. D. W. Barrett (Smith's English Clocks, Ltd.) who began by pointing out that his firm had large investments in, and had been founded on, spring-driven clocks. Therefore, he could claim to be impartial in saying that it would not have taken up the electric type had it not been assured of its future.

While the electric clock might lack the individuality of the spring-wound type it also lacked its eccentricities. The latter, he suggested, could not be relied upon to show accurate time. It also needed regular winding and regulation and its parts were delicate. The electric clock needed no attention and was robust. Electric clocks did stop when the current failed, but the average consumer would only have his supply interrupted once during a year. Even now he knew of areas where no break had been recorded for over three years.

Regarding the reliability of electric clocks, he instanced two reports of retailers, one having sold several hundred clocks during five years, the other 8,000. In both cases they had only had one failure. The same service could be rendered by any good make of electric clock.

These clocks had only been in existence for about seven years; 75 per cent. of them were sold through the electrical trade. While in the U.S.A. 65 per cent. of the sales were of electric clocks, in this country between 30 and 33⅓ of the money spent on clocks during 1937 went on the synchronous type. This, he thought, was remarkable evidence of their public favour when it was remembered that the spring-wound clock had been in existence over 300 years compared with seven of the electric.

There were about 45 million clocks in use in this country, the bulk of them being spring-driven. That potential market should be grasped by everyone who sold electric clocks. The sale of one electric clock usually meant a return to the shop for another. There was also the additional market created by the immunity of the clock to extremes of heat and damp. There were six to seven million bathrooms and kitchens in this country on a.c. supply that had no clocks in them. Yet a clock was very necessary in the bathroom.

Criticism of the electric clock then came from such well-known horologists as Commander Gould, R.N., who insisted that they were not time-keeping instruments in the true sense of the word in so far as they possessed no inherent time-keeping properties. However, he, together with other experts, admitted that they felt the electric clock to be the clock of the future, much as they deplored it. It was also mentioned that electric clocks used for recording in industry were better because they could handle more power.

Fundamentals of Generation

GREAT interest was aroused at the meeting of the London Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION on January 11th at Westminster by Prof. W. M. Thornton's lecture on "The Fundamental Principles of Electric Generation."

Poynting's law, he said, underlay every electrical action in the universe, but it was never mentioned and one never thought twice about it, a fact which caused him some distress. The wide generalisation discovered by Prof. Poynting in 1885 as the result of a mathematical examination of Maxwell's paper on electro-magnetic theory was almost unknown to electrical engineers, and yet was probably the most important law in engineering physics after the electro-magnetic theory of light. Maxwell stated in mathematical terms that energy could travel through space and, since the ether of space was a perfect insulator, it followed, although Maxwell had not foreseen it, that when energy was transmitted by electro-magnetic means it was carried by the insulation and was only *guided* by the conductor along which the energy travelled. But it was Poynting who found that the rate of flow of energy, *i.e.*, the power transmitted, depended equally on the electric field *in the insulation* and the magnetic field always associated with the flow of current. In free space the current was the rate of change of the electrical displacement in the ether, the same kind of current that flowed in a condenser. But whatever the nature of the current, the same relation held that the power P transmitted per sq. cm. in watts was the product of the electric field E in volts per cm. and the magnetic field H expressed in ampere-turns per cm.

The function of the insulation of the windings of a machine was not merely to separate the wires, or to isolate them from earth, but to transmit the energy generated; 98 per cent. of the energy delivered by the engine to the generator never entered the copper of the windings of the machine. If it did, it would stay there, for no energy that ever entered a metal by electro-magnetic means ever came out again, unless as radiation when the metal became red hot. The energy travelled through a generator, or through a motor, by way of the insulation alone. It entered a generator through the shaft, turned right and left through the slot insulation of the windings, passed to the insulation of the brushes and terminals, travelled along the insulation of the line and so reached the load.

In a study of the fundamentals of generation the behaviour of insulation as a carrier of energy was more important than the metal of the windings, or the manner in which the windings were arranged Nor did the energy transmitted along the windings depend upon the magnitude, or intensity, of the magnetic field of the poles. It depended only on the voltage between the conductors and the teeth or sides of the slots, and on the magnetic field in the space between the copper and the teeth due to the current flowing in the conductors. If there were no current, of course, power would not be transmitted, although the full pole flux passed through or across the conductors. It was the circular magnetic flux around the conductors or coil edges that had to be considered. Thus, by Poynting's formula, if the voltage from a conductor through the slot insulation were, say, 5,000 V per cm. and there were 200 ampere-turns in the slot, the power passing along the slot insulation parallel to the current flow would be 5,000 × 200 W, or 1,000 kW per sq. cm. That great and fundamental relation, known as Poynting's law, was immensely more important than Ohm's law, yet it was not taught or discussed, but there was a reason for its neglect. They were perfectly well able to get on without it in practice because the system of units, which was developed and accepted about the same time as Poynting's paper appeared, enabled them to short-circuit it in thinking of the energy developed in a machine, or transmitted along a line; much in the same way that one accepted the symbolical statement of Ohm's law, $i=e/r$, without thinking of the reason for it.

Ohm's law simply meant that when a current passed through a conductor, energy was absorbed, or that the current was proportional to the pressure applied, but it was not a new law of nature in the same sense as Faraday's law of electrical induction, or Maxwell's great formula for the transmission of radio waves, or Poynting's law. It was, in effect, a statement that the laws of particle mechanics, applied to electron collisions. Poynting's law did more. It stated, first, that power travelled by the reaction between an electric field (which might be stationary or, as in the case of radio waves, alternating) and a magnetic field which required for its maintenance the flow of a current and was, therefore, either in itself dynamic or was a steady sweep of the ether caused by the movement of an electric charge through it. The law defined by Poynting was shown by him to be universal in its application to all cases of the movement of electric charge and, since all matter was electric, it followed that all energy, mechani-

A corner of the art exhibition held last week by Henley's head office staff (see p. 98)

cal or electrical, was fundamentally electromagnetic in nature. The law should apply, therefore, to all cases of the transfer of energy, such as that by a belt or a shaft.

The direction of transfer had always to be considered when energy was transferred. Poynting had shown that it must always flow at right angles to both the electric and magnetic fields, in a way represented by a right-hand rule. For instance, in a concentric cable the electric field was at right-angles to the surface of the conductor, the magnetic field was concentric with it; the direction which was at right angles to both of those, and satisfied the right-hand rule, was parallel to the conductor. The energy transmitted, therefore, flowed in the space between the conductors, *i.e.*, in the insulation, parallel to and in the same direction as the current.

The direction of flow of energy was not always simple to determine. For example, how did energy change from potential to kinetic in the swing of a pendulum? The answer involved a knowledge of the nature of gravitation and if we were ever to obtain an answer to such questions, Dr. Thornton suggested, it must come through a consideration of the electro-magnetic case, with Poynting's law as a basis, and a belief in the identity of energy as something as real as matter itself.

That the ether was a perfect fluid endowed with rotational elasticity had long been held by those most competent to judge. If it had elasticity it could be strained, *i.e.*, it could take up a position under the influence of the action of electric charges at rest or in motion from which, as it relaxed, it could hand on similar strains without loss of energy in the process. The special significance of Poynting's law was that it indicated how that occurred, by the interaction of two fields, electric and magnetic, at right angles to one another. One thought of an electric field from a positive charge as a right-handed twist. If through that field there were made to pass another field, a straightforward displacement, not in itself rotational about its line of direction, the resultant displacement would be the direction in which power would be transmitted by their mutual reaction. The Poynting relation was satisfied if one could regard the field from a positive charge as having a right-handed torsion. Such a conception, if it were accepted as adequate, would help materially to explain how energy was transferred, both in the ether of space and in the insulating materials that carried both the electric stress and the magnetic fields that were the essential parts of all electro-magnetic machinery.

Machine Mining.—"The Installation and Protection of Coal-face Plant" was discussed by Mr. R. Crawford, Electrical Inspector of Mines, at a large gathering of colliery managers and mining electrical engineers in Glasgow on January 15th. The meeting was held under the joint auspices of the West of Scotland and Ayrshire branches of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS and the Scottish branch of the NATIONAL ASSOCIATION OF COLLIERY MANAGERS. Mr. Crawford pointed out that the development of intensive machine mining was largely due to the availability of electricity as an efficient, cheap, and flexible form of power. He regarded it as important that the men who used coal-cutters and other electrically driven machines should be properly trained if the machinery were to be used to the best advantage. The majority of the speakers in the following discussion stressed the point that the proper installation and protection of coal-face electrical equipment must be supported by sound maintenance and proper handling to ensure the maximum measure of efficiency.

Feed Water Treatment.—At a meeting at Cardiff on January 8th of the South Wales Branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS, Mr. G. S. Irving lectured on the conditioning of boiler feed water with particular reference to steam purity as affecting deposits and corrosion in turbines. He said that whether the treatment was internal or external, each case of boiler feed water treatment called for full consideration of the engineering and chemical features individually. Experience counted for much where the purity of steam was a vital factor. One should first study the cause of the particular trouble and follow that with close analyses of the results, and then bring into practice the remedies through knowledge gained by specialised experience.

Physical Papers.—Some indication of the part physical science is playing in industry was given at a discussion on new materials organised by the London branch of the INSTITUTE OF PHYSICS on January 18th. The conference dealt with metal alloys, optical glasses and dielectric substances. Dr. L. Hartshorn (N.P.L.) described advances made in the production of synthetic resins and mentioned the ketone type produced at Teddington.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Motor Starting Regulations

It would appear that so far as supply authorities are concerned motor-starting regulations constitute a difficult question and it is seldom that there are any two regulations the same. No doubt this is due to the fact that conditions vary in different districts according to the load on the mains. The squirrel-cage motor is the simplest and cheapest type of motor, and yet it is often rejected by the supply authorities, due to the starting current.

One particular case can be mentioned. A small owner of a circular saw wished to electrify his machine, which was driven by a petrol engine. A 6-h.p. squirrel-cage motor would have been suitable, but the supply authorities insisted on a slip-ring motor, which, together with the more costly control gear, made it too expensive for the small owner to install. The saw is still being driven by the petrol engine. F. SMALLWOOD,

District Manager,

Nottingham, *January 14th.* Veritys, Ltd.

Distribution in the Lake District

In your issue of January 7th you make a reference to the recently proposed overhead line up Borrowdale. An error, though by no fault of your own, occurs in your report, which error has an important bearing on the case. You refer to the Mid-Cumberland Electricity Company as having "offered to put the line underground from Catbells (near the bottom end of Derwentwater) to Seatoller at the foot of the Honister Pass" (a distance of 6¼ miles), and you quote the chairman of the Electricity Committee of the Cockermouth Rural District Council as describing the whole opposition to the scheme as "absurd," since so much would have been buried.

As secretary to the conference of the four amenity societies which were negotiating with the Mid-Cumberland Company will you allow me to say that the company at no time made any such offer at all as the one which you quoted. Its maximum offer was to bury approximately one-third of the total course of the proposed line. The company refused even to negotiate on burying any longer section of the line. The total length of the line would have been 7½ miles; if the company had offered to bury 6¼ miles from Catbells to the foot of Honister, the societies would certainly not have taken the attitude which they did take in pressing for a public inquiry by the Minister of Transport. The "absurdity" lies not in the attitude of the societies but in the ignorance of the facts shown by the chairman of the Electricity Committee of the Cockermouth Rural District Council. H. H. SYMONDS.

Grasmere, *January 13th.*

Charges for Cooker Wiring

I have read the complaint in your issue of January 14th regarding the cost of cooker wiring and, assuming that your correspondent, Mr. Cousins, is an electrical man, it rather surprises me that he cannot be more precise in his description.

What size cooker was wired—6-W or 6-kW? If the supply company fitted a main switch at the intake and a cooker control at the cooker, I cannot see what he is grumbling about whatever size cooker it was. I cannot understand his last paragraph.

I am not connected with the supply industry.

January 14th. PRO BONO PUBLICO.

Holidays with Pay

I am very anxious to obtain details of any voluntary efforts made by individual firms which have already granted holidays with pay, to provide facilities for their employés' holidays.

I am familiar with many of the schemes promoted by the larger firms in the country and certain cases where holiday homes have been provided, but there must be many hundreds of smaller firms with whom one can only get into contact by means of Press correspondence. May I, therefore, take advantage of the hospitality of your columns to invite any employers who may be willing to do so to send a note about their holiday schemes to the Industrial Welfare Society, 14, Hobart Place, Westminster, S.W.1? ROBERT R. HYDE,

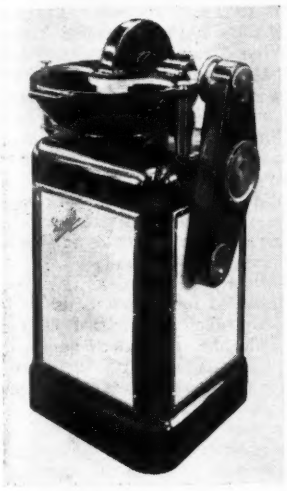
London, S.W.1, *January 12th.* *Director.*

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Meat Chopper

THE SILENT MACHINE & ENGINEERING CO., LTD., Albion Works, Savile Street, Sheffield, 4, has achieved a "whirlpool" action in its new "Swift" meat cutter, thus ensuring that the ingredients are distributed uniformly throughout the whole of the commodity in the minimum of time. This is accomplished by means of a specially shaped revolving bowl and high speed knives which impart a centrifugal motion.

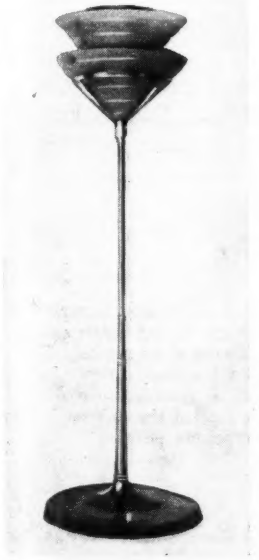


"Swift-Whirlpool W.15" meat chopper

The "whirlpool" action is incorporated in the model "W.15," in which there is an automatic interlocking knife and bowl cover arrangement making it impossible to engage the drive until the covers are in the running position. The patented arrangement of the stainless steel knives ensures that they are correctly fitted and adjusted. The bowl is of a special alloy with rust-resisting qualities, and accurately machined, and the interior of the knife cover and underside of the bowl cover are coated with pure tin. The drive is by means of three-point chain gearing, positive in action, totally enclosed and running in an oil bath, the bowl drive being through a worm gear. Operation is by a built-in totally enclosed 2-h.p. motor, ball bearings being used throughout. The output is 400 lb. per hr.

An Artistic Air Purifier

A new design of air purifier has been developed by HAROLD ASHTON, Bull's Head Passage, Market Place, Manchester, 4. It is intended mainly for hotel lounges and is mounted on a standard 6 ft. high with a weighted base 18 in. in diameter.



The Ashton air purifier

There are two coloured bowls, the lower one containing water and a fan and the upper one three 40-W lamps. The principle is that the fan draws air through a spray caused by a cone (driven off the fan spindle) dipping into the water. The lamps illuminate the swirling water, giving a pleasing decorative effect. Perfuming and disinfecting as well as air washing and purifying can, of course, be carried out, there being two "in-line" pear switches providing independent control of the lighting and purifying. The same unit can be obtained mounted on a shorter pedestal to form a table standard.

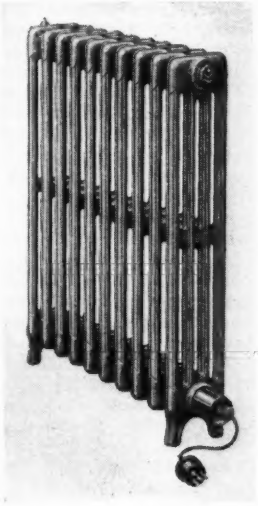
Improved Miners' Lamps

Improvements in the capacity of the batteries and the efficiency of the bulbs have enabled manufacturers to produce miners' lamps which more than comply with the minimum requirements of the Regulations. Further improvements have been made by the use of miners' lamps capable of utilising bulbs of still higher wattage, but, in spite of this, the lighting in mines is far from adequate even to-day.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has, by the use of krypton gas, brought about an increase in light output from miners' lamps of from 20 to 30 per cent. without any sacrifice of lamp life. Krypton, like argon, is one of the rare gases present in the atmosphere, but in much smaller quantities, the proportion being of the order of one part in a million. Owing to its rarity this gas is very difficult and expensive to extract, but miners' electric lamp bulbs are small in volume and do not require much of it. These bulbs are already in production in sizes and ratings suitable for miners' electric lamps, operated by either acid or alkaline batteries.

Electric Hot-water Radiators

IDEAL BOILERS & RADIATORS, LTD., Hull, have long been known for their boiler-fed hot-water radiators. A recent introduction is a range of hot-water radiators designed on similar lines to the company's standard radiators but fitted with immersion elements loaded at 1, 1½ or 2 kW and suitable for 200/210, 220/230 or 240/250-V supplies. All radiators are 5⅝ in. deep, but vary from 18 to 48 in. long and 24 to 36 in. high. Non-standard sizes can be supplied to special order.



An "Ideal" electric hot-water radiator

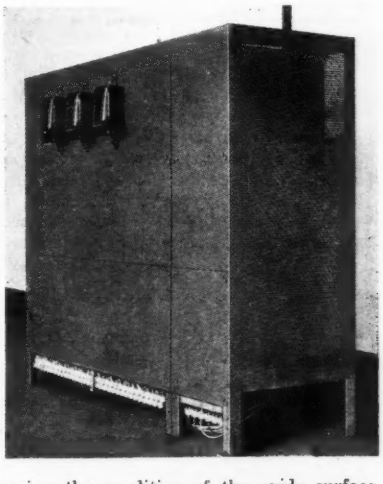
In the ordinary way three-heat switches are supplied. To secure the most economical use of this type of heating, however, thermostatic control is to be recommended. Antique bronze cellulose is the standard finish.

Translucent Moulded Shades

Many delicate colourings and attractive designs are available in a new range of translucent moulded shades which LIGHTING TRADES, LTD., 51-55, Garratt Lane, Wandsworth, London, S.W.18, have just placed on the market. They are considerably cheaper than glass and much more robust, while the evenness of the moulding ensures perfectly true hanging of the shades.

A Colliery Battery Charging Unit

Reliability is essential in colliery battery charging as each miner must have a fully charged lamp before entering the pit. Special attention has been devoted to this in the new charger just introduced by F. C. HEAYBERD & CO., 10, Finsbury Street, London, E.C.2. Metal rectification is employed throughout, and a special oil immersed type has been developed primarily with a view to eliminating the possibility of corrosion due to acid fumes or climatic conditions.



A 16-kVA Heayberd colliery battery charger

An advantage of this type of rectifier is that all heat is rapidly transmitted through the oil and cooled by the tank sides, and bearing in mind that damage due to overloading is caused by the heat developed changing the condition of the oxide surface of the rectifier plates, severe overload may be safely applied for prolonged periods without damage, until the temperature of the oil reaches an excessive value.

The battery charger illustrated has a rectified output of 16 kVA, and deals with five thousand 4-V lamps daily. The output is divided into sixty-four completely isolated circuits and an additional six circuits for operating unlocking magnets. By this means it is impossible for discharges to take place in the event of a failure of supply, or of a "short" occurring on one bank of batteries. Each circuit is fitted with a rewirable fuse and arranged for direct connection to the battery racks, which carry a slide control for current regulation, battery fuses, and an ammeter.

Continuously Evacuated X-ray Tubes

Demountable type for high-voltage operation

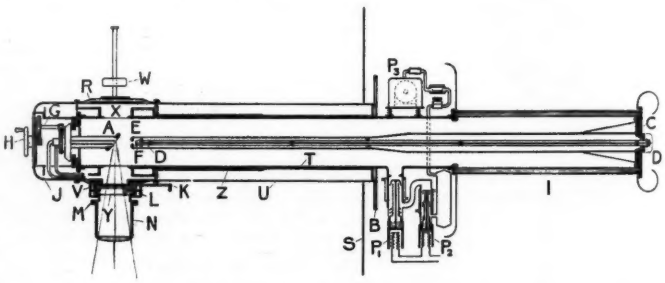
SIXTEEN 250-kV tubes of the continuously evacuated demountable type are now in service for cancer treatment in hospitals in Manchester, Sheffield, Edinburgh, Aberdeen and Cairo, and one of 1,000-kV in the Mozelle Sassoon High-Voltage X-ray Therapy Department of St. Bartholomew's Hospital, London, is claimed to give an X-ray beam of greater penetrative power, higher intensity and shorter mean wavelength than any previously employed for cancer treatment. Other tubes for 500 kV are under construction.

The essential points of this type, which has been developed by the Metropolitan Vickers Electrical Co., Ltd., are that the tube can be taken apart for repair or renewal of its internal parts and that it is continuously evacuated by improved pumps mounted upon it. Hitherto, even with Langmuir mercury-condensation pumps, liquid air has been necessary for obtaining the final vacuum and consequently demountable tubes were limited to academic conditions, sealed-off glass tubes being used for general purposes.

The new developments are a direct outcome of a discovery by Mr. C. R. Burch in the Met.-Vick. laboratories of a range of oil residues of extremely low volatility, having vapour pressures of the order of 10^{-6} mm. Hg. These oils, now known as the "Apiezon" series (oils "without pressure") act, first, as a vacuum seal, and, secondly, as an improvement upon mercury in condensation pumps. They permit the evacuation of apparatus quickly to a pressure of about 10^{-6} mm. Hg., which is well below the vacuum required for X-ray tubes.

The advantages obtained are that tubes can be constructed of more robust materials (*e.g.*, porcelain instead of glass) by ordinary engineering methods, and can be used up to their ratings and under severe conditions, owing to the ease of maintenance resulting from the demountable construction, whereas sealed-off tubes were commonly operated below their rated voltages, involving a disproportionate reduction in radiation, in order to prolong their life.

Control desk for 250-kV X-ray tube installed at Christie Hospital and Holt Radium Institute, Manchester, with view of tube



Section of continuously evacuated 250-kV X-ray tube

A is the target. C, B, D and E the cathode-tube. J the anti-cathode assembly. M the applicator. P_1, P_2 are condensation pumps. P_3 the backing pump. R applicator cylinder. Z 5 mm. of protective lead.

Control must be automatic in starting, regulation and safeguarding against mishap (*e.g.*, failure of cooling water supply) for twenty-four hours a day if necessary, with but scanty attention from the technical staff. In order to avoid adverse psychological effects upon the patient the new equipments are arranged with the high-voltage generating apparatus, controls, &c., in an adjoining room; only a horizontal cylinder finished in cream cellulose with chromium plated fittings appears in the treatment room.

Within this cylinder the tube itself is enveloped in thick sheet lead to confine the X-rays to the shuttered treatment aperture.

Behind a metal partition, in an adjoining room, are the insulator for the high-voltage electrode of the tube, the high-voltage generator, the pumping equipment and the control apparatus

The 250-kV tubes are designed for current up to 10 mA. They differ from the Holfelder tube in that the steel "cannon" is the X-ray tube itself, and the target is almost at the extreme end of the tube instead of at its mid-point. Further, as the target is at earth potential, cooling water may be taken direct from the supply mains. The applicator head may be rotated through 300 deg. and this, together with the horizontal movement of the treatment couch, enables a patient to be treated in almost any position.

Motor-driven raising and lowering gear is provided for adjusting the position of the tube with regard to the patient. The d.c. generator equipment consists of a transformer, two thermionic rectifiers and two condensers. The rectifiers are also of the demountable continuously evacuated type. A control desk is used to initiate the operation and to regulate automatically the operating components, indicate the vacuum and safeguard the equipment from damage from a fault or a failure in supply.

At "Bart's" the size of the 1,000-kV, 5-mA tube and its auxiliary gear makes it simpler to raise and lower the floor than to move the tube itself. The tube completely bridges the treatment room and power is supplied by two 500-kV generators housed in rooms at the two ends of the tube. The generators and tube are controlled from a desk in a separate room. As protection against scatter radiation the walls are constructed of barytes blocks designed and made at the Met.-Vick. works. A system of convex mirrors gives the radiologist a view of the patient during treatment and microphones make conversation between them possible.

The cathode carries six tungsten filaments mounted on a hexagonal rotatable block. Should a filament burn out the cathode is removed and the block rotated through 60 deg. to bring another filament into the working position.

Electric Vehicle Show

CO-OPERATIVE effort among electricity undertakings and manufacturers in N.W. England and N. Wales has prepared the ground well for the holding of an electric vehicle show on January 26th and 27th at the Electricity Works, Frederick Road, Salford. It is intended that this shall be an annual event in the Manchester district, in addition to co-ordinated demonstrations at smaller centres which will also be accompanied by lectures and discussions on delivery problems. Several such local shows have already been held and, as they were preceded by local Press advertising and mail publicity, interest has been aroused and the attendance has been good. Since the formation of the Area Committee of the Electric Vehicle Committee of Great Britain in February, 1935, the number of battery vehicles in use has greatly increased, having risen from 125 to 543 at the end of October last, the registrations for each of the three years being 80, 161 and 177 (up to October 31st). Included in these are the Manchester figures of 12 initially, which became 208 as a result of corresponding increases in the numbers registered of 29, 64 and 103. The Area Committee has been able to secure standardisation of tariffs among sixty-eight of the larger undertakings, in whose supply areas 90 per cent. of the potential users of electric vehicles operate. These undertakings have adopted its recommended tariff of ½d. per kWh in urban areas and ¾d. in rural areas for energy taken for charging purposes from ten to twelve hours at night. As the area includes seaside and other places with varying times of system maximum demand, standardisation has not been effected in night-charging hours, but in some cases no restriction is placed on the period at which the low rates are allowed. In Manchester the use of the vehicles is spread over twenty-five concerns, the largest fleet being one of 59 run by the Manchester and Salford Co-operative Society. The average consumption per vehicle in Manchester is about 5,350 kWh per annum, representing more than 1,100,000 kWh sold at night. The potential demand is estimated to be equivalent to at least 25 million kWh per annum, or 5 per cent. of the present total consumption in the Manchester supply area. At Salford papers will be read by Mr. J. Steele on "Light Delivery Vehicles," and by Mr. D. F. Pilkington on "A User's Experience of Heavy Electric Vehicles," and the show is to be followed by an intensive propaganda campaign.

British Overseas Electrical Trade

In 1937 exports increased by £3,367,000 and imports by £593,000

THE closing month of last year was distinguished by the fact that British electrical exports were of a higher value than in December of any year for at least a decade, the total of £1,800,286 comparing with the previous best of £1,711,880 in 1929. This was the culmination of an excellent last quarter in which each month exceeded its predecessor. Compared with the corresponding month of 1936, which contained an equivalent number of working days, December's total was up by £290,842, or 19 per cent.

TABLE I.—EXPORTS AND IMPORTS DURING DECEMBER.

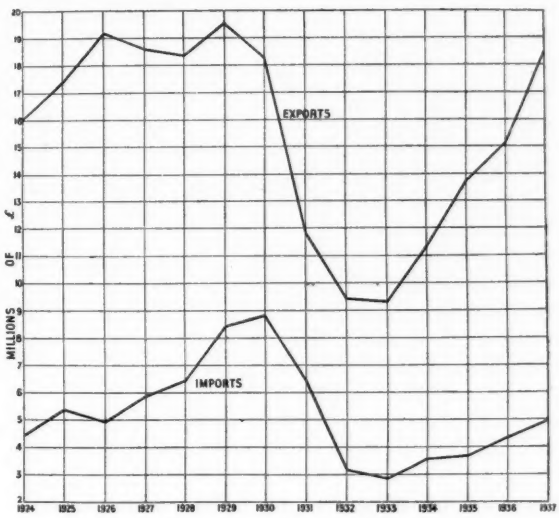
	Exports. Dec., 1937.	Exports. Inc. or dec. compared with Dec., 1936.	Imports. Dec., 1937.	Imports. Inc. or dec. compared with Dec., 1936.
Submarine telegraph and telephone cables	£6,906	− £4,846	*	—
Telegraph and telephone wires and cables (not submarine)	71,846	+ 24,816	*	—
Other insulated wires and cables	325,539	+ 94,584	£34,241	− £2,398
Radio receivers, not radiograms (excluding valves)	38,552	+ 3,084	9,860	− 18,001
Radio transmitters (excluding valves)	20,056	+ 2,890	*	—
Radio valves	39,765	+ 1,923	10,737	− 10,042
Other radio parts and accessories	63,082	+ 17,102	50,575	− 14,248
Telegraph and telephone apparatus (other than radio)	198,120	− 10,215	*	—
Electric carbons	*	—	7,431	− 6,327
Incandescent lamps	59,329	+ 14,823	14,993	− 3,766
Other lighting apparatus	50,929	+ 9,232	53,911	+ 1,250
Primary batteries	19,005	+ 4,028	*	—
Accumulators	41,716	− 29,022	*	—
Electric cooking and heating apparatus	30,495	+ 4,031	*	—
House service meters	16,940	− 1,168	*	—
Other electrical instruments	26,124	− 1,379	36,024	+ 11,546
Unenumerated electrical goods and apparatus	146,406	+ 25,305	78,750	+ 5,298
Electric generators up to 200kW	58,307	+ 24,332	*	—
Electric generators over 200kW	41,710	− 49,054	*	—
Electric motors	153,260	+ 21,159	39,736†	+ 6,816
Convertors and transformers	146,753	+ 90,494	*	—
Starting and controlling gear for motors	37,710	− 13,831	*	—
Switchgear	165,107	+ 53,997	*	—
Other electrical machinery	14,287	+ 3,620	32,390	+ 20,353
Electric vacuum cleaners	27,742	+ 4,937	19,901	+ 5,278
Total	£1,800,286	+ £290,842	£388,549	− £4,241

* Not classified separately. † Not railway and tramway motors.

The detailed figures given in table I compiled from information given in the Board of Trade returns for December, show that the increases were again widely distributed. Particularly noteworthy, however, is the 60 per cent. improvement in shipments of machinery other than motors and generating plant, for which South Africa was mainly responsible with an increase of £91,780. Exports of converting and transforming plant were more than two and a half times as much, by value, as in the corresponding month of 1936, and the definite upward trend in this section in recent months is indicated by the following figures: September, £50,166; October, £61,069; November, £80,610; and December, £146,753. Despite smaller shipments of generating plant, the total value of machinery exported (£644,876) was the highest for years. The aggregate weight was 3,652 tons, against 2,941 tons in December, 1936.

Ever since February exports of wires and cables have each month exceeded the 1936 values by at least £100,000—in some cases considerably more—and December was no exception. The following analysis of last month's shipments, according to destination, relates to wires and cables other than telegraphic and telephonic, and the values in parentheses are for December, 1936:—

Rubber insulated wires and cables.—Australia, £37,588 (£28,753); South Africa, £20,187 (£25,433); New Zealand, £11,740 (£12,243); British India, £10,174 (£16,940); other British countries, £24,509 (£13,968); and foreign countries, £17,681 (£12,393).



Curves showing electrical exports and imports in each year since 1924

Electric wires and cables, insulation other than rubber.—Australia, £53,165 (£33,400); South Africa, £34,573 (£31,328); British India, £30,759 (£19,896); other British countries, £47,513 (£21,307); and foreign countries, £37,650 (£15,294).

Shipments of telegraph and telephone apparatus maintained a good average figure but were rather less than in December, 1936. The principal destinations, with comparative values, were as follows:—Australia, £51,236 (£42,795); Argentina, £28,638 (£12,124); South Africa, £17,714 (£11,935); other British countries, £39,909 (£35,678); and other foreign countries, £60,623 (£105,803).

There was a further small decrease in imports in December. Contrasting with the rise of £22,109 in exports of radio

TABLE II.—BRITISH ELECTRICAL EXPORTS DURING DECEMBER.

Destination.	Goods and apparatus, Dec., 1937.	Inc. or dec. compared with Dec., 1936.	Electric generators, Dec., 1937.	Inc. or dec. compared with Dec., 1936.	Electric motors, Dec., 1937.	Inc. or dec. compared with Dec., 1936.	Other electrical machinery, Dec., 1937.	Inc. or dec. compared with Dec., 1936.
Ireland	£42,320	− £13,490	*	—	*	—	*	—
Channel Islands	17,308	− 4,009	*	—	*	—	*	—
Union of South Africa	144,826	+ 13,272	£15,796	− £28,277	£31,583	+ £7,641	£152,096	+ £91,780
British India	115,903	+ 14,926	22,132	− 15,054	23,767	+ 7,186	38,340	+ 4,234
British Malaya	39,424	+ 14,590	*	—	*	—	8,172	− 1,092
Ceylon	10,441	+ 4,215	*	—	*	—	*	—
Hong Kong	22,392	+ 16,003	*	—	*	—	*	—
Australia	207,149	+ 46,391	8,137	− 7,526	26,512	+ 5,818	22,880	− 715
New Zealand	72,160	+ 3,794	*	—	12,744	+ 7,286	17,011	+ 5,339
Canada	16,428	+ 8,778	3,732	− 6,434	2,777	+ 126	18,772	+ 14,983
Other British Countries	74,296	− 3,117	16,817	+ 6,901	17,291	+ 963	37,719	+ 11,375
Sweden	27,735	+ 16,621	*	—	*	—	*	—
Denmark	22,505	− 265	*	—	*	—	*	—
Netherlands	15,319	+ 1,373	*	—	*	—	2,791	− 3,170
Belgium	8,590	− 3,118	*	—	*	—	*	—
France	23,489	+ 4,335	*	—	*	—	2,076	+ 509
Portugal	4,542	− 16,428	*	—	*	—	*	—
Spain	2,555	+ 703	*	—	*	—	*	—
Italy	6,223	+ 5,857	*	—	*	—	*	—
Greece	7,469	+ 3,209	*	—	*	—	*	—
Rumania	11,052	+ 7,628	*	—	*	—	*	—
Egypt	20,166	+ 14,029	*	—	*	—	1,361	+ 300
China	8,551	+ 648	*	—	*	—	705	− 1,700
Brazil	9,242	− 1,699	*	—	*	—	*	—
Argentina	60,941	+ 14,641	*	—	*	—	6,728	+ 2,005
Other Foreign Countries	164,484	+ 6,301	33,403	+ 25,668	38,586	− 7,861	55,206	+ 10,432
Total	£1,155,410	+ £155,188	£100,017	− £24,722	£153,260	+ £21,159	£363,857	+ £134,280

* Not classified separately. Vacuum cleaners are included in Table I but not in Table II.

receivers, valves and accessories, imports declined by £42,291. On the other hand, whereas exports of electrical instruments were down, imports increased by £11,546.

The following is an analysis of the chief sources from which goods and apparatus were obtained last month, with comparative values: Germany, £76,129 (£77,076); United States, £71,231 (£93,717); Netherlands, £55,587 (£62,897); Belgium, £18,376 (£23,656); Switzerland, £14,758 (£18,588); France, £10,709 (£6,896); Austria, £6,626 (£7,194); other foreign countries, £32,076 (£27,971); and British countries, £11,030 (£15,215).

In the machinery section imports showed a substantial increase, the total weight being 446 tons against 281 tons in December, 1936.

TABLE III.—EXPORTS AND IMPORTS DURING 1937.

	Exports. 1937.	Exports. Inc. or dec. compared with 1936.	Imports. 1937.	Imports. Inc. or dec. compared with 1936.
Submarine telegraph and telephone cables	£111,421	+ £35,968	*	—
Telegraph and telephone wires and cables (not submarine)	806,018	+ 295,786	*	—
Other insulated wires and cables	3,484,085	+ 1,122,672	£586,889	+ £192,453
Radio receivers, not radiograms (excluding valves)	381,257	+ 86,506	158,432	− 78,793
Radio transmitters (excluding valves)	257,618	+ 24,506	*	—
Radio valves	466,341	+ 62,337	231,579	− 5,893
Other radio parts and accessories	547,060	+ 111,115	1,007,919	+ 177,796
Telegraph and telephone apparatus (other than radio)	2,117,383	+ 352,784	*	—
Electric carbons	*	—	118,174	− 22,058
Incandescent lamps	653,720	+ 57,399	189,084	+ 16,407
Other lighting apparatus	619,889	+ 116,838	572,697	+ 50,518
Primary batteries	191,574	+ 8,632	*	—
Accumulators	597,177	+ 31,905	*	—
Electric cooking and heating apparatus	341,325	+ 71,118	*	—
House service meters	191,162	− 7,368	*	—
Other electrical instruments	246,758	+ 22,691	334,297	+ 53,623
Unenumerated electrical goods and apparatus	1,534,138	+ 133,522	884,176	+ 37,054
Electric generators up to 200 kW	438,161	+ 99,698	*	—
Electric generators over 200kW	717,437	+ 109,815	*	—
Electric motors	1,504,698	+ 288,364	361,047†	+ 23,029
Convertors and transformers	848,844	+ 18,987	*	—
Starting and controlling gear for motors	456,718	− 124,553	*	—
Switchgear	1,565,840	+ 382,450	*	—
Other electrical machinery	161,503	+ 27,162	316,757	+ 146,163
Electric vacuum cleaners	267,042	+ 39,056	191,592	+ 2,620
Total	£18,507,159	+ £3,367,390	£4,952,643	+ £592,919

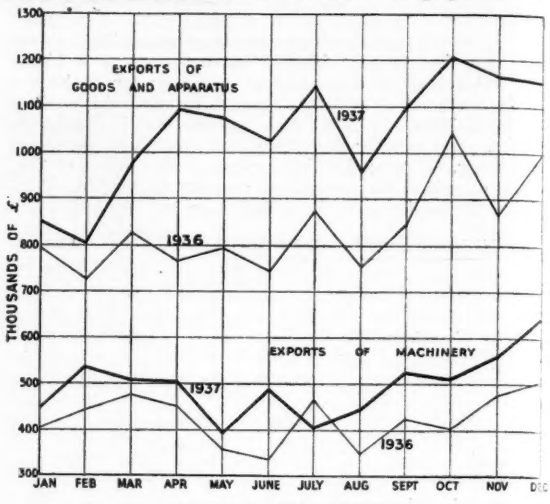
* Not classified separately. † Not railway and tramway motors.

As is shown in table III, the total value of electrical exports in 1937 was £18,507,159, an increase of £3,367,390. This represents an improvement of 22 per cent., which is considerably more than the rise in prices could have amounted to. The year was an exceptionally good one for the cable-making industry, whose exports rose by £1,454,426 to £4,401,524. Excluding telegraph and telephone wires and cables, the total was £3,484,085, allocated as follows (comparative values for 1936 in parentheses):—

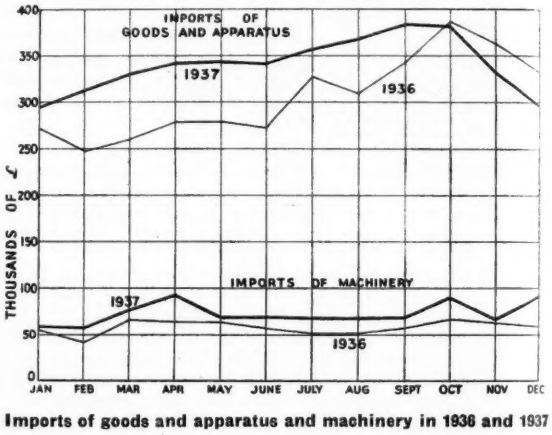
Rubber insulated wires and cables.—Australia, £443,232 (£338,904); South Africa, £340,525 (£298,587); British India, £204,043 (£173,906); New Zealand, £102,928 (£93,896); other British countries, £250,294 (£155,899); and other foreign countries, £189,324 (£119,798).

Electric wires and cables, insulation other than rubber.—South Africa, £530,732 (£328,664); Australia, £445,143 (£248,687); British India, £333,395 (£217,887); other British countries, £362,419 (£210,857); and foreign countries, £282,049 (£174,328).

The Australian market was the best for telegraph and telephone apparatus other than radio, unclassified British countries also being good customers. The following is an analysis of the chief destinations, with comparative values: Australia, £565,191 (£302,636); South Africa, £238,637 (£321,940); Argentina, £176,891 (£267,991); other British countries, £568,997 (£353,348); and other foreign countries, £567,667 (£518,684).



Exports in 1936 and 1937



Imports of goods and apparatus and machinery in 1936 and 1937

TABLE IV.—BRITISH ELECTRICAL EXPORTS DURING 1937.

Destination.	Goods and apparatus, 1937.	Inc. or dec. compared with 1936.	Electric generators, 1937.	Inc. or dec. compared with 1936.	Electric motors, 1937.	Inc. or dec. compared with 1936.	Other electrical machinery, 1937.	Inc. or dec. compared with 1936.
Ireland	£477,230	+ £11,706	*	—	*	—	*	—
Channel Islands	172,336	+ 17,326	*	—	*	—	*	—
Union of South Africa	2,021,767	+ 249,080	£241,631	+ £70,357	£367,305	+ £64,163	£980,714	+ £6,016
British India	1,407,591	+ 206,442	171,885	− 49,307	179,442	+ 7,846	451,742	− 40,805
British Malaya	358,943	+ 100,364	*	—	*	—	92,334	− 5,701
Ceylon	127,398	+ 30,072	*	—	*	—	*	—
Hong Kong	140,005	− 9,725	*	—	*	—	*	—
Australia	2,127,957	+ 710,677	185,641	+ 39,610	187,491	+ 47,025	342,380	+ 143,220
New Zealand	1,008,305	+ 346,629	*	—	95,426	+ 49,736	184,856	+ 40,940
Canada	171,602	+ 67,401	93,198	+ 25,443	81,605	+ 29,644	64,545	+ 37,893
Other British Countries	897,142	+ 314,300	252,991	+ 63,962	201,552	+ 53,818	352,507	+ 95,816
Sweden	159,720	+ 17,291	*	—	*	—	*	—
Denmark	217,640	+ 46,709	*	—	*	—	*	—
Netherlands	172,701	+ 25,293	*	—	*	—	37,694	+ 16,364
Belgium	150,688	+ 30,719	*	—	*	—	*	—
France	196,164	+ 1,085	*	—	*	—	37,881	+ 4,706
Portugal	138,188	+ 50,966	*	—	*	—	*	—
Spain	33,625	− 18,507	*	—	*	—	*	—
Italy	58,507	+ 31,713	*	—	*	—	*	—
Greece	66,732	+ 31,462	*	—	*	—	*	—
Rumania	140,409	+ 70,861	*	—	*	—	*	—
Egypt	127,014	+ 32,347	*	—	*	—	13,846	− 978
China	169,311	+ 26,760	*	—	*	—	26,592	− 6,211
Brazil	143,958	− 96,457	*	—	*	—	*	—
Argentina	544,254	+ 5,156	*	—	*	—	33,530	+ 12,091
Other Foreign Countries	1,317,739	+ 226,741	210,252	+ 59,448	391,867	+ 36,132	414,284	+ 695
Total	£12,546,926	+ £2,526,411	£1,155,598	+ £209,513	£1,504,688	+ £288,364	£3,032,905	+ £304,046

* Not classified separately. Vacuum cleaners are included in Table III but not in Table IV.

Besides substantially increasing in value, exports of radio apparatus also improved in quantity. Altogether 68,669 sets (other than radio-gramophones) were shipped abroad last year against 55,644 in 1936, and valves sent out numbered 1,724,000

(1,338,000). Electric lamp exports increased in number from 18,023,000 to 20,321,000, but fewer house service meters were exported (167,173 against 178,205), with a drop in value from £198,530 to £191,162.

Australia was the largest customer for British electrical goods and apparatus, with £2,127,957, followed by South Africa with £2,021,767. It is interesting to observe that there were decreased shipments to three destinations only—Hong Kong, Spain and Brazil. In regard to the last named, a large railway electrification contract made the 1936 figures exceptionally high. Development in British Malaya is reflected in the increase of £100,364 (39 per cent.) in exports of apparatus to that country. Among foreign countries which increased their custom Rumania is noteworthy, shipments being double as much as in 1936. There was a considerable growth in trade with unclassified countries, British and foreign.

In the machinery section there was also a large improvement in exports, especially of switchgear (+£382,450) and motors (+£288,364). Motor shipments to New Zealand were doubled in value, as were exports of "other electrical machinery" to Canada.

Apart from value, exports of machinery were of greater weight (tons) as the following analysis reveals: Generators, 6,550 (5,696); motors, 10,285 (8,327); "other electrical machinery," 17,688 (16,841); electrically operated vacuum cleaners, 521 (465).

Electrical imports during 1937 amounted in value to £4,952,643, an increase of £592,919 (14 per cent.). As with exports, there was a large increase in the case of wires and cables (+£192,453). Fewer radio sets were imported (60,000 against 87,243), but there was a substantial rise in the value of parts and accessories brought in. The number of valves imported rose from 2,306,000 to 2,338,000, but the value declined. The number of electric lamps received from abroad rose from 54,804,000 to 62,391,000.

The chief sources from which goods and apparatus were received, with comparative values, were as follows: United States, £1,026,506 (£1,033,646); Germany, £987,122 (£831,876); Netherlands, £827,695 (£649,638); Belgium, £327,386 (£215,666); Switzerland, £210,428 (£219,097); France, £91,827 (£119,479); Austria, £69,295 (£72,312); other foreign countries, £385,691 (£335,905); and British countries, £157,297 (£184,521).

Imports of machinery according to weight (tons) were as follows: Motors (not railway and tramway), 1,970 (2,085); other machinery, 1,504 (679); and electrically operated vacuum cleaners, 437 (408).

In the Courts

IN a Divisional Court of King's Bench, consisting of the Lord Chief Justice and Justices Branson and Humphreys, the case of Long *v.* G. F. Kirk & Co., Ltd., was heard last week on the appeal of Mr. Long, a factory inspector, from a decision of the justices of Oldham (Lancs), dismissing an information under Section 76 and 136 of the Factory and Workshop Act, 1901, alleging an offence under the Act by Messrs. G. and F. Kirk & Co., Ltd., building contractors, of Chesterfield.

While executing work on the Grand Theatre, Oldham, in February, 1937, the appellant alleged that the respondent company had allowed to be used a covered electric wire which was dangerous. A man named Furlong, who was engaged on a night shift breaking up a foundation, intended to bring from a boiler house an electric lamp at the end of a long lead. He was found dead, his hand having come into contact with a strand of bare wire. The justices dismissed the information, holding that Furlong created the wire lead into a "trailer" without authority when it was only intended to be a hanging cable and had been passed by an electrician for that purpose.

Mr. Valentine Holmes, in support of the appeal, said that the lead had been used on the building for some time and a foreman had carefully scrutinised it and repaired it when necessary but at one point it was found that a piece of rag had surrounded a bare strand and had become wet and it was the current from that point that killed Furlong. He (counsel) submitted that the justices should have convicted the respondent company and have taken into consideration the matters that were relevant. The Act said that an electric cable should be properly insulated and the one in the present case could not have been, or Furlong would not have been killed.

Mr. Maude, having supported the decision of the justices on behalf of the company, the Court allowed the appeal with costs. The Lord Chief Justice, in giving judgment, said he thought that the justices had come to a wrong conclusion. The Act was imperative that all electric conductors should be adequately insulated and safeguarded so as to prevent danger. It did not say that sufficient insulation could be achieved by a foreman who patched up the cable at points where it became frayed. In the present instance there could not have been adequate insulation and the case would have to go back to the justices with the direction that on the facts before the Court an offence had been committed.

The other members of the Court concurred, and the appeal was accordingly allowed with costs.

Telsen Electric Co. v. Eastick & Sons

The case of the Telsen Electric Co., Ltd. (in liquidation), formerly of Birmingham, against J. J. Eastick & Sons, of 118, Bunhill Row, London, E.C., after an interval of about fifteen months, again came before Mr. Justice Lawrence in the King's Bench Division on January 14th and 17th, in the form of an appeal from a decision of the liquidator of the plaintiff company, Mr. C. Latham. (The previous proceedings were reported in the ELECTRICAL REVIEW of October 30th, 1936.)

The plaintiff company had carried on business as manufacturers of wireless receiving sets, radio gramophones and component parts, and the action was brought to recover from the defendants the balance of a sum alleged to be due for wireless sets, &c., sold by them to the defendants in 1934. Subject to liability the sum due to the plaintiffs was agreed at £416.

The defendants, however, counterclaimed for damages laid at between £1,400 and £1,500 for alleged breaches by the plaintiffs of the sales agreement for price maintenance, for service after sale of the sets, and for facilities for the hire-purchase of the goods by the defendants' customers. The defendants, after the receiver for the debenture-holders of the plaintiff company was appointed, continued to do business with the receiver, but eventually the whole of the plaintiff company's stock was thrown on the market which ended the hire-purchase facilities, the result being, as the defendants alleged, in their being left with sets and components on their hands which became unsaleable at list prices. The plaintiff company was wound up in December, 1934.

When the case was before his Lordship in October, 1936, he held that the defendants were entitled to claim damages on the counterclaim, the assessment of which was referred to the liquidator, Mr. Latham.

Mr. Croom-Johnson, K.C., for the defendants, said that Mr. Latham had come to the conclusion that the defendants had not proved any damage at all. It was evident that Mr. Latham had arrived at his decision on a basis of his own, and in the circumstances it was necessary to come back to his Lordship in order to know what the position was.

Mr. Miller, K.C. for the plaintiff company, took the preliminary point that that Court had now no jurisdiction in the matter, or to send the case back to Mr. Latham, or to interfere with his Lordship's determination. He (Counsel) contended that the defendants were taking the wrong course. If the defendants desired to appeal against the result they could do so to the Divisional Court, but he submitted they could not now come back to his Lordship.

At the conclusion of the argument his Lordship held that the defendants in the circumstances should have appealed to the Divisional Court from the liquidator's decision, but gave the defendants leave to appeal from his Lordship's judgment to the Court of Appeal.

Pentode Valve Patent Action

In the Chancery Division on January 13th a pending action brought by Mullard Radio Valve Co., Ltd., against British Belmont Radio, Ltd., Balfour House, Finsbury Pavement, E.C., came before Mr. Justice Morton on an application for the fixing of a day for the hearing of a motion on behalf of the plaintiffs for leave to amend the specification.

Counsel, in support of the application, said there were a number of opponents to the motion. The action was a patent action which involved highly technical considerations with regard to a particular form of pentode valve. The motion for leave to amend the specification would probably last a week or even longer as expert evidence would be called. Both parties desired that the witnesses should give the evidence in Court and not by affidavit. He (counsel) suggested that February 1st next would be a convenient day to begin the hearing of the motion and to that counsel for the defendants agreed.

After some discussion his Lordship fixed January 26th for the hearing of the motion

Winding-up Order

In the Companies' Court on January 17th Mr. Justice Bennett had before him a petition for the winding-up of Ridgelite Electric Co., Ltd., 30, Islington Green, London, N. Counsel stated that there were two judgment creditors for £607 and £169 respectively. Nobody appeared for the company and his Lordship made the usual compulsory order.

Works Visit

By permission of the building owners, Sir Robert McAlpine & Sons, Ltd., members of the Association of Supervising Electrical Engineers visited Great Westminster House, Horseferry Road, on January 8th. The building is one of two large blocks of offices recently erected, and included in the plant inspected were the transformer rooms, the rising mains and water treatment plant. Mr. Morris L. Winslade (representing the architects, T. P. Bennett & Son) conducted the party.

Business and Industrial Notes

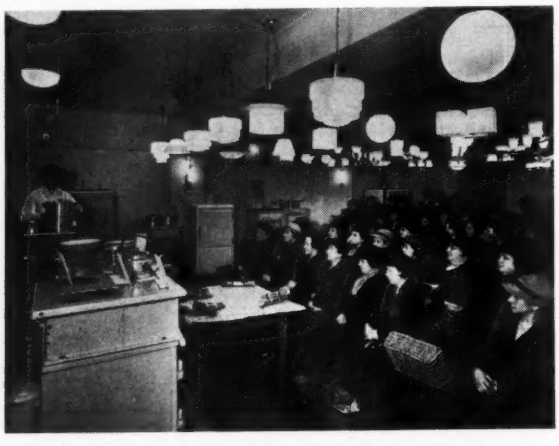
The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The "Electrical Review" Index

The index to Vol. CXXI of the ELECTRICAL REVIEW (July-December, 1937) is now available. Any reader who requires a copy may obtain one gratis from the Publisher, ELECTRICAL REVIEW, Dorset House, Stamford Street, S.E.1. Cloth binding cases may also be obtained at the price of 3s. 6d. each (3s. 10d., post free).

Electricity House, Ltd.

Electricity House, Ltd., in which are represented the Yorkshire Electric Power Co., Electrical Distribution of Yorkshire, Ltd., the North Lincolnshire and Howdenshire Electricity Co., Ltd., and the Penrith Electric Supply Co., is now operating as an independent company, and to mark this important step the staff from Leeds and all branches were recently invited



A cooking demonstration in progress in the Halifax showrooms of Electricity House, Ltd.

to meet the directors in the Philosophical Hall, Leeds, when Mr. J. E. Rylands, the general manager, spoke of the pioneer work done during the past two and a half years, and of the company's future aims and ambitions. Mr. W. B. Woodhouse, managing director, touched on the numerous uses of electricity, and Col. H. C. Fraser and Mr. J. J. H. Stansfield (directors) also spoke. Mr. J. Fawcett proposed a vote of thanks on behalf of the staff. The launching of Electricity House, Ltd., coincides with the opening of three new shops at Barnsley, Halifax and Cockermouth. The Barnsley premises replace a smaller shop which the company has had in the town for the past two years and occupies the ground floor and basement, the latter being used as a demonstration kitchen. The lay-out of the Halifax premises is attractive, a staircase at the back of the ground floor showroom leading to a demonstration kitchen on the first floor. Our picture shows one of the cooking demonstrations at this showroom in progress. At Cockermouth an old dwelling house has been entirely rebuilt and modernised and makes an effective contrast to the old house opposite in which Wordsworth lived in the latter part of the nineteenth century. New premises are shortly to be opened in Lincoln.

Birmingham and Midland Institute Exhibition

Several interesting electrical exhibits were on show during the annual four-day conversazione organised by the Birmingham and Midland Institute, which concluded on Friday last. High-frequency and other electrical experiments were conducted by Mr. J. B. Kramer, who demonstrated a full-size model of Faraday's cage—by which Faraday proved that an electrical charge on a sphere or hollow conductor resided only on the outside—and Tesla coil apparatus, both lent by the Royal Institution. Mr. Kramer also demonstrated a photo-electric colour sorting machine, which sorted out balls of various colours by means of the rays reflected from their surfaces. There was also a photo-electric fire quencher, designed to prevent the spread of a fire or an explosion, and a photo-electric temperature recorder, showing that the temperature of a hot body corresponds to the wave length of the colour of the flame or heat produced. Electrically conducting rubber was exhibited by the Dunlop Rubber Co., Ltd., the demonstrator explaining that material which had been regarded as one of the best forms of insulation could be made into a useful conductor by recent technical developments. The properties and commercial applications of the new rubber were demonstrated; it was shown that it could be used in aeroplane tyres, where it conducted electrical charges to earth on landing, and also for hospital flooring, for the elimination of frictional electrical charges. Other electrical apparatus on show included electric shavers, a "Powerlite" electric lantern, a coffee percolator (all lent by Walker Bros., Birmingham); a working model electric railway (lent by Barney's, Ltd., Birmingham); scale models of the Droitwich National transmitter (lent by the B.B.C.); and the "phono-switch" (exhibited by Messrs. F. H. Lane, A. N. Ward and F. Inchley), which responds to a hand clap or speech in switching on or off a radio set, altering the volume of the set or lighting a lamp.

Henley Artists

This year's art exhibition arranged by the Henletel Social and Athletic Club (W. T. Henley's Telegraph Works Co., Ltd.), was, if anything, better than the first one held last year. About 50 exhibitors were responsible for 140 items in the various classes—oil and water colours, photographs, models, furniture, needlework, &c. Mr. A. S. Brewer again showed his versatility, and for his oil painting, "Childish Things," received one of the three special prizes presented by Sir Montague Hughman, chairman of the company, the others going to Miss T. Brett (firescreen), and jointly to Messrs. W. Shelly and A. T. Crowe for their models of the *Victory* and *Cutty Sark*. Several examples of their work were shown by Messrs. J. Dunford Smith, C. Baggott, F. Baggott, W. M. Baxter, and Mecklenburgh. The greatest originality was again found in the Children's Class.

Electrically Operated Sluices

With reference to the new Allington sluices which were described in our last issue (page 68), Ransomes & Rapier, Ltd., inform us that they designed, manufactured and installed all the sluice gates, counterbalancer operating gear, motors and electric control gear, including all the wiring.

South African Municipal Engineers

At the annual convention of the Association of Municipal Electricity Undertakings of South Africa and Rhodesia recently held in Durban the following members were elected to the Executive Council for the ensuing year:—*President*, Mr. J. H. Gyles, city electrical engineer, Durban; *vice-president*, Mr. H. A. Eastman engineering assistant, Capetown; *past-presidents*, Messrs. A. Rodwell, city electrical engineer, Johannesburg, and G. G. Ewer, city electrical engineer, Pietermaritzburg; *members of council*, Councillor H. G. Capell, chairman, Electricity Committee, Durban; Councillor W. James, chairman, Electricity Committee, Capetown; Councillor H. Middlebrook, Durban; Councillor L. Hofmeyer, Stellenbosch, alternate; Mr. E. A. Behrens, city electrical engineer, Port Elizabeth; Mr. L. L. Horrell, city electrical engineer, Pretoria; Mr. J. S. Clinton, city electrical engineer, Salisbury; and Mr. G. M. Pirie, city electrical engineer, Bloemfontein. The secretary and treasurer is Mr. E. Poole, Durban.

Electricity Supply in Yorkshire

On the completion of important extensions to its Thornhill (Dewsbury) power station, the Yorkshire Electric Power Co. is inviting the members of the local authorities in its area of supply to visit the premises and on January 13th members of the Dewsbury Corporation were the company's guests. After a tour of the station they were entertained to luncheon at which the managing director of the company, Mr. W. B. Woodhouse, welcomed them and mentioned that for a number of years the company's stations had held the proud record of the lowest production costs. He expressed the opinion that new industries would be more and more attracted to the vicinity of the large power stations, particularly those industries engaged in electro-chemical processes. In the company's early days it received little sympathy. It had to prove its claim to existence and it found growing support from the public authorities in the districts which it was serving, although for some time there appeared to be a sort of jealousy on the part of the larger municipalities which he believed had now passed away. There was a general appreciation today that the company's policy of unification conceived about thirty-seven years ago was right. They were seeing the same trend on the part of other public utilities. In electrical matters they knew that the Government took the view that a similar unification must take place, and he believed that when it did the municipalities would be exercising their duties to much greater benefit by endeavouring to safeguard the public interests without the bias which was inseparable from municipal trading. These were not isolated movements, but general, and when the time came to consider the Government's proposals for electricity he trusted that they would be able to agree among themselves what was best to be done and not be forced, by legislation, unwillingly to do the right thing.

Edinburgh Contractors' Dinner

The annual dinner of the Edinburgh branch of the Electrical Contractors' Association of Scotland was held at the North British Station Hotel, Edinburgh, on January 14th. Mr. G. Mackintosh, chairman of the branch, presided over a large gathering, and among the guests were Mr. E. Seddon, engineer and manager of the Electricity Department of the Edinburgh Corporation, Mr. Pinkerton, president of the Edinburgh Master Plumbers' Association, and Mr. J. Aikman, past chairman of the Scottish Wholesale Federation. The toast of "The Guests" was proposed by the chairman. Councillor Gardner, replying, referred to the friendly spirit in which the Electrical Contractors' Association had met the Town Council and said that he hoped this spirit of give-and-take would continue. It was to the mutual benefit of both the supply industry and the electrical contractors, but it was also to the greatest benefit of the ordinary consumer. They did not wish to have any opposition between private enterprise and local authorities. Speaking for the city of Edinburgh, he said that in spite of the big increase in the price of coal and of cables, and the advance in wages, they had not been called upon to advance the price of electricity. Mr. Hugh Fulton, Glasgow, president of the Electrical Contractors' Association of Scotland, and Mr. R. Kilpatrick, Dundee, vice-president, also acknowledged the toast.

The Japanese Electricity Supply Industry

A *Reuter* message from Tokyo states that three draft Bills in connection with the proposed State control of the electricity supply industry have been published by the Government. The first Bill embodies provisions for State control of the industry which, it is planned, will be effected through a new semi-official holding company to be called the Electric Industry Development Co., Ltd. The second Bill refers to the establishment of the new company, which will undertake the generation and transmission of electric power. The third Bill provides a guarantee for the foreign loans and debentures issued by the electric power companies which subscribe the capital of the new company. This Bill stipulates that the Electric Industry Development Co. shall guarantee the service and redemption of such foreign loans and debentures.

Lead Seals for Meters

British Insulated Cables, Ltd., is in a position to supply the special pattern of lead seal prescribed by the Electricity Commissioners under the Electricity Supply (Meters) Act, 1936, for the sealing of meters. It can also supply suitable sealing pliers engraved as required, and spiralled sealing wire for use with these or other lead seals.

Anglo-American Trade Negotiations

At a meeting of the Grand Council of the Federation of British Industries on January 12th the fullest preliminary discussion with British industry of all points likely to arise in the negotiations with the United States for an Anglo-American Trade Agreement was urged upon the British Government, and the Council has requested Lord Hirst to seek an interview with the President of the Board of Trade, in order to inform him personally of the state of industrial feeling on this question. Mr. Oliver Stanley, the President of the Board of Trade, had informed the Federation that he was unable to depart from the present procedure of the Government of confining consultation with industry to the question of the concessions which it is proposed to ask the United States to make, and that the publication of information as to the concessions which the United States may request in respect of our import duties while the negotiations were in progress might be embarrassing to the Government. In a letter in reply to Mr. Stanley, Lord Hirst states that the Federation is anxious to avoid any action which might embarrass the Government. He points out, however, that the Federation has not asked that such information should be published, but merely that United Kingdom industries should be given an opportunity of expressing their views upon any concessions asked for by the United States, and he is convinced that any industries consulted would, if requested, regard such consultations as being of a confidential nature. He realises that British industry does not enjoy the same legal right as American industry of expressing its views upon any concessions which may affect its interests, but the need for close consultation upon a matter so vitally affecting British industrial interests is so great that he hopes Mr. Stanley will reconsider his decision and thus secure that British industry should not be placed at a disadvantage as compared with American industry in this matter. Moreover, in view of the fact that negotiations are to take place in America where representatives of British industry will not be available for consultation, it would appear more than ever important that the fullest preliminary discussion with British industry of all the points likely to arise in the negotiations should take place.

The M.A.R.S. Exhibition

At the M.A.R.S. Exhibition of Modern Architecture now in progress at New Burlington Galleries, W.1 (see last week's issue, p. 65), a 2-kW inset type "Thermovent" heater which will be available shortly for general release, has been adapted by the designer of the "living room" to include a reflector-type radiator. In addition two portable "Thermovents" have been provided by the manufacturers, E. K. Cole, Ltd., who, under the "Ekco" trade mark, are also responsible for a built-in television receiver and a built-in radio with record-changer.

Hungarian Lamp and Radio Valve Industry

In a recent issue of *Elektrotechnika*, considerable space is devoted to the electric lamp and radio valve industry in Hungary, the position of which has been improved by the development of the new krypton-filled lamps. Thus the exports of electric lamps from Hungary during 1936 increased by 10 per cent. over those of the preceding year. Shipments of Hungarian radio valves advanced during 1936 by 28 per cent., although there was a decline of 43 per cent. in the gross value.

The s.s. "Stratheden"

Siemens Electric Lamps & Supplies, Ltd., inform us that many thousands of Siemens lamps have been installed on the new P. and O. liner *Stratheden*.

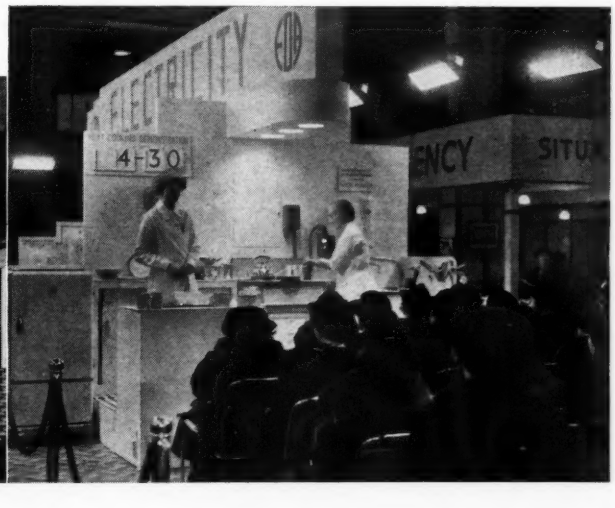
Improving Domestic Service Conditions

In view of the fact that it is to electricity that much of the praise for the improved conditions of domestic service during recent years is due, it is appropriate that the electrical industry should be strongly represented at the Domestic Services Exhibition now being held at the Royal and New Horticultural Halls, Westminster. The home being largely the women's province, it is right, too, that one of the most effective exhibits is that of the Electrical Association for Women, whose recently introduced Home Workers' Campaign is doing such good work not only in raising the status of those engaged in domestic duties but also in reducing labour by educating home workers in the proper use and care of domestic electrical appliances.

Visitors are showing much interest in electrical matters and the British Electrical Development Association's demonstrations of electric cooking, water heating and refrigeration have been packed out. In addition to the demonstration theatre there is ample space on the E.D.A. stand to display typical examples of up-to-date cooking appliances, cleaners, domestic laundry equipment, washing-up machines, water heaters and numerous small appliances such as fires, convectors, hair dryers, clocks, fans, warming pads, coffee percolators, toasters, hotplates, casserole cookers and other food preparation apparatus. A specially interesting exhibit is a model showing the layout of the prize-winning kitchen submitted in the E.D.A. Architects' Competition.

Below: Explaining the E.A.W.'s Home Workers' Campaign at the Domestic Services Exhibition. Right: A cooking demonstration in progress on the E.D.A. stand

[Elec. Rev. photos.



Various ways in which electricity has alleviated drudgery in the home are also demonstrated on the stands of Beatty Bros., Ltd. (laundry equipment); Dizer Manufacturing Co., Ltd. (cleaners); W. T. Driver ("Empire" trouser presser and "Driver" heating attachment for fans); Electronaire Marketing Co. (a new combined cleaner and air heater, described in our December 31st issue, p. 932); Foremost Electrics, Ltd. (general domestic appliances); Hoover, Ltd. (cleaners); Hurley Machine Co. (England), Ltd. ("Thor" laundry equipment); Rollnick & Gordon (combined cleaner, scrubber, polisher and lawn mower); Stokes Appliances, Ltd. (table cooker and plate warmer); and Wilkins & Mitchell ("Servis" electric washers). The Electricity Consumers' Association also has a stand and Major Raymond Phillips demonstrates his latest invention, the "human polarity indicator."

A Neon Window Installation

The accompanying illustration shows a Claude-General Neon installation in the windows of Sir Henry Lunn, Ltd., Haymarket, S.W.1. In the two name signs high-intensity green tubing is used for the word "Lunns" in 2-ft. 9in. and 2-ft. letters with high-intensity blue for the remaining words which are in 3-in. letters. These signs are arranged with backed troughs top and bottom for concealing the electrodes and h.v. wiring. For the circular sign (a representation of St. Christopher) 73 ft. of 7 mm. blue and green tubing is used, the stainless steel rim being superimposed with approximately 18 ft. of 7 mm. blue tubing.

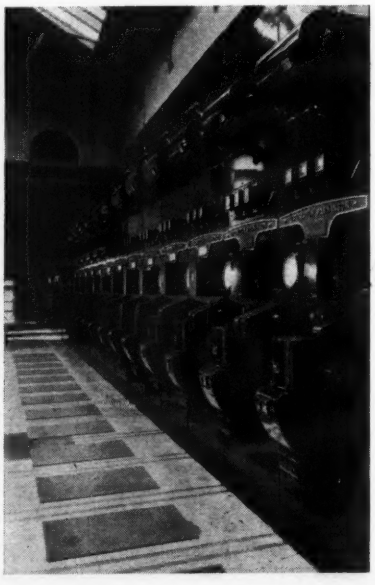
Social Events

The annual staff ball of the North Metropolitan Electric Power Supply Co. will be held on February 4th at Seymour Hall, Seymour Place, Marylebone Road, W.1. Tickets (3s. each) can be obtained from Mr. P. A. Thorogood, hon. general secretary (sports section), Electricity House, Edgware.

The staff annual dinner and dance of Santon, Ltd., was held on January 14th at the Westgate Hotel, Newport (Mon), and was attended by a number of engineers and friends from different parts of the country. Following the dinner there

A Variety of Products

ROLLING stock equipment for the London Passenger Transport Board's tube extensions is one of the outstanding features of Crompton Parkinson's traction shops. This includes about 800 motors embodying substantial improvements in rate of acceleration and flexible speed characteristics. This order followed one received earlier in 1937 by the Crompton - West combination for all the motors and one set of train equipment for four experimental tube trains and, *via* the B.T.H. Co., another large order for control gear for new tube stock.



Crompton - Parkinson e.h.v. truck-type board at Ilford: 26 6,600-V remote electrically operated cubicles with duplicate bus-bars and oil switches of 350,000-kVA rupturing capacity

An order for the whole of the equipment for sixty-four two-coach units on North Tyneside has been carried out for the L.N.E.R. through Associated Manufacturers of Electric Traction Equipment, Ltd., under whose auspices the experience of the B.T.H. Co. in the design of control gear and layout of the stock now being replaced on account of age, was available to Crompton-West. Diesel-electric railcars and locomotives illustrate another line of activity, the automatic control system formerly developed by Armstrong Whitworth being employed.

In the trolley-bus field orders have been received *via* the Associated Manufacturers for 150 sets of control apparatus for London Transport, while other equipment is in hand or has recently been delivered for Ipswich, St. Helens, Penang, Norway (for Ransomes, Sims & Jefferies) and Belfast. These bring the total number of vehicles fitted with the concern's motors or control equipments in all parts of the world to over 400. Tramways also continue to call for equipment, e.g., twenty for modern vehicles at Blackpool and a further repeat order for traction motors for Sunderland.

Noteworthy among installations recently carried out is the complete sub-station apparatus for the Earls Court Exhibition, comprising six 1,500-kVA and four 750-kVA transformers with on-load tap-changing, 11-kV, 150,000-kVA and low-voltage switchgear, auxiliary plant, and 11-kV cable interconnecting the sub-stations. Another industrial installation is the six-unit 11-kV switchboard at Gillette's new factory, incorporating 150,000-kVA circuit-breakers with vertical isolation, oil-immersed current transformers, compound-filled bus-bar chambers, and a six-unit 400-V "Klad" board. Also at this factory are three 500-kVA, 11-kV/400-V transformers by the British Electric Transformer Co. The cable was manufactured at C.P.'s Derby works.

Switchboards have also been constructed for the Stanton Ironworks, consisting of ten panels rated at 100,000 kVA at 3.3 kV, and for the Ley Street change-over at Ilford (illustrated) comprising twenty-six 6.6-kV, 350,000-kVA truck-type units with remote electrical operation and duplicate bus-bars.

Motors to the extent of 1,700 h.p. have been provided for the new grain silo at Brunswick Dock, Liverpool, and to the extent of 2,500 h.p., ranging from 1 to 130 h.p., for the chemical works of British Industrial Solvents, Ltd., as well as others of various sizes for the Runwell Mental Hospital, Ismay Cable Works (also switchgear), the West Lancashire R.D.C. sewage scheme at Sefton and the Harefield Asylum.

Among the generators supplied are those for the Newmarket totalisator. A secondary lighting set has been provided at D. H. Evans's stores, including a motor generator supplying 300 A to a 1,050 h.p. battery floating across its terminals. A control panel with change-over switches enables the secondary supply to be switched over to the primary when the generator is not running.

Some unusual features are to be found in a B.E.T. 600-kVA furnace transformer, upon which are mounted the associated reactances and tapping switches, providing for varying voltages down to 80 V and reactances up to 35 per cent. Of more conventional design is a three-phase, remote-operated on-load tap-changing transformer for the Erith extensions.

In the illuminating field there are two new products, the "Crompton" range of discharge lamps and "Neophan" glassware, in which neodym is introduced in its oxide form to offset the preponderance of yellow rays in the spectrum of the tungsten-filament lamp.

Typical of overseas orders are 25 miles of cable and 950 lamps supplied to the Dunedin (N.Z.) post office through the New Zealand agents of Crompton Parkinson, Ltd., who also manufactured the sub-station equipment and main switchgear, and a duplicate 37,500-kVA, 132/22/11-kV transformer of the oil-immersed naturally cooled outdoor core type with a shipping weight of 60 tons for the State Electricity Commission of Victoria. Foreign contracts include part of an order for boring mills for Russia, fans for the Canton-Hankow railway and motors for pumps on the Buenos Aires Great Southern Railway.

was dancing until a late hour, and on the following morning many of the visitors inspected the works at Somerton.

The annual dinner and dance of the Lothians Electric Power Co. was held on January 7th in McVittie's Rooms, Edinburgh, Mr. F. Helling, president of the company's Technical Society, presiding. Among those present were Mr. E. Seddon (city electrical engineer, Edinburgh), Mr. H. Payn (engineer and manager, Boston and District Supply Co.), Prof. M. G. Say (Heriot Watt College), Mr. Pound (burgh electrical engineer, North Berwick), Mr. B. White and Mr. R. P. Beddow, directors of the company, and Mr. E. A. Bond (secretary). Mr. Beddow said that 1937 was a year of steady progress, but they had not yet experienced that expansion in business which alone could justify the reduction of ¾d. per kWh which they made some time ago in their domestic two-part tariff. During the year they connected about 1,000 new consumers and the sales increased by about 10 per cent. over the preceding year. Mr. E. Albert proposed the toast of "The Lothians Electric Power Co.," and Mr. H. C. Babb (general manager) also spoke.

The annual luncheon of the salesmen of the Crompton Lamp & Rubber Cable Depot (Lancashire, Cheshire and North Wales Area) and the Northern Steel and Hardware Co., Ltd., was held on January 15th in Manchester.

Prime Minister at B.I.F. Banquet

The Prime Minister has consented to be principal guest and speaker at the banquet to be given by the Government at the Mansion House, by the courtesy of the Lord Mayor, on February 21st to mark the opening of the British Industries Fair. The President of the Board of Trade, Mr. Oliver Stanley, will president.

Norwich & District E.D.A. Circle

An E.D.A. Circle for the Norwich and district has recently been inaugurated. Mr. H. A. Greenfield, the vice-chairman, in a statement said that the new Circle would help to promote better co-operation between all trade members in the area. They intended to ensure that a high standard of electrical work was maintained, and they would impress this fact on the public at exhibitions and other displays. The officers of the new Circle are: President, Mr. V. A. Pask (electrical engineer of Norwich); chairman, Mr. R. W. Steel; vice-chairman, Mr. H. A. Greenfield; hon. secretary, Mr. A. C. Green; and hon. treasurer, Mr. A. Pank. Other committee members are: Messrs. V. C. Davies (B.T.H.), J. Newton (Henley's), D. Giles (Flinders'), A. Belbin (Electrical Conduits), and C. C. Fisher. Meetings are to be held on the first Tuesday of every month at the Circle's headquarters, Duke Street. A dinner will be held on February 9th.

The Bristol Electric Club

On Friday last Mr. S. P. B. Mais gave an address before the Bristol Electric Club in which he gave his impressions of a recent visit to the United States.

The Empire Exhibition

A special issue of the *Imperial Review* has been published giving preliminary details of the Empire Exhibition which will be opened at Bellahouston Park, Glasgow, on May 3rd. The various industries of Scotland are described in a series of illustrated articles.

British Plant for South Africa

A *Reuter* message from Johannesburg states that tenders totalling £830,000 have been awarded to British companies for construction work in connection with the new power station of the Johannesburg Municipality. The work includes turbo-generator plant and condensers as well as boilers and cranes. The General Electric Co., Ltd., (British) has been recommended for the generators and condensers and Babcock & Wilcox for the boilers. The first section of the power station is to be ready in 1940.

Price of Materials

Henry Gardner & Co., Ltd., report, January 19th: Copper bars (best selected), sheet and rod, £79, £5 increase. English pig lead, no change. Spelter, no change. English block tin, £190, £1 5s. increase.

Frederick Smith & Co. report, January 19th: Electrolytic copper bars, £48 5s., 15s. decrease. Ditto, ditto, wire rods, £53 15s., 15s. decrease. Ditto, ditto, h.c. wire, 8½d., ¾d. decrease. Silicium bronze wire, 9½d., ½d. decrease.

Edward Till & Co. report, January 19th: India rubber, Para fine, 7d., ½d. decrease.

New Catalogues and Lists

British Thomson-Houston Co., Ltd., Rugby.—A well-illustrated technical booklet dealing with "Twenty-five Years of Magneto Development."

A. F. Bulgin & Co., Ltd., Abbey Road, Barking.—The first of a new series of periodical reports of progress and development in radio accessories.

British Electrical Repairs, Ltd., 213, Witton Lane, Birmingham, 6.—Details and examples of the company's repair service.

Turner's Asbestos Cement Co., Trafford Park, Manchester, 17.—A folder describing "Siluminite" flexible asbestos insulation.

Adam Hilger, Ltd., 98, King's Road, Camden Road, London, N.W.1.—A booklet describing the "Spekker" photo-electric absorptiometer.

British Insulated Cables, Ltd., Prescot, Lancs.—Leaflets appertaining to loom-woven textile finish for flexible cables.

Bankruptcy Proceedings

L. T. Wilson, 30, Yardley Road, Acocks Green, Birmingham, formerly carrying on business at 563, Coventry Road, Birmingham, radio and electrical engineer.—The first meeting of creditors was held recently at the Official Receiver's office, 159, Great Charles Street, Birmingham, when a statement of affairs was submitted showing liabilities of £211 and assets of £56, leaving a deficiency of £156. Debtor attributed his failure to lack of capital, insufficient turnover to provide for expenses, &c. The matter was left in the hands of the Official Receiver as trustee.

W. G. Johnson, 71, High Street, Smethwick, Staffs, and 303, Oldbury Road, Smethwick, radio dealer.—The first meeting of creditors was held on January 12th at the Official Receiver's office, 159, Great Charles Street, Birmingham, when a resolution was passed appointing Mr. F. E. Bendall, of Poppleton & Appleby, Midland Chambers, Warwick Passage, Birmingham, as trustee of the estate with a committee of inspection. According to the debtor's statement of affairs there was a deficiency of £1,508 on gross liabilities of £2,936.

W. J. Fishbourne, 7, Tynewydd Terrace, Newbridge, Mon, electrical and mechanical engineer.—This debtor's public examination took place at the Town Hall, Newport (Mon), recently. His statement of affairs showed liabilities of £233 and assets of £112, leaving a deficiency of £121. Debtor attributed his failure to inability to collect book debts and insufficient work. The examination was adjourned.

R. C. Marshall (Northern Service Depot), radio dealer, 318, Stretford Road, Manchester.—Application for discharge to be heard on January 31st at the Court House, Quay Street, Manchester.

H. N. Wicks (Harold Wicks & Co.), electrical specialist, Railway Hotel Buildings, Greenhithe, and 8, Stone Street, Gravesend.—Application for discharge to be heard on February 16th at the Court House, Rochester.

S. L. Bapty, carrying on business with another as the Wireless Instrument Manufacturing Co. at Avenue Works, Avenue Road, Willesden Junction, N.W.—Discharge suspended for four months until April 25th, 1938.

W. H. Secker (Modern Wireless Depot), 93, Magdalen Street, Norwich.—Discharge suspended for three months until March 13th, 1938.

A. E. Baker, electrical engineer, 42, Chapel Road, Bexley Heath.—Trustee, Mr. F. C. Wells, 280a, High Street, Rochester, Official Receiver, released December 30th.

G. Linds, electrical contractor, 4, Red Lion Street, Holborn, W.C.1.—Receiving order made January 12th on a creditor's petition. First meeting January 25th and public examination February 25th, both at Carey Street, W.C.

S. W. Bridges, 37, Melgund Road, Highbury, N.5, lately trading as British and American Radio Service Co. at 10 and 11, Field Place, St. John Street, E.C.1, and 219, Pentonville Road, N.1.—Trustee, Mr. L. A. West, Carey Street, W.C.2, Senior Official Receiver, released December 31st.

A. King, wireless and electrical dealer, 6, Beresford Square, Woolwich, S.E.13.—Trustee, Mr. C. R. Waterer, 29, Russell Square, W.C.1, Official Receiver, released December 31st.

H. T. Cable (Lighthouse), radio and electrical engineer, 171, Fog Lane, Didsbury, Manchester.—Trustee, Mr. F. H. Langmaid, Byrom Street, Manchester, Senior Official Receiver, released December 31st.

E. M. Swift, electrical engineer, 10, Joinings Bank, Langley Green, Worcester.—Trustee, Mr. R. K. Clark, 159, Great Charles Street, Birmingham, Official Receiver, released December 31st.

J. V. Wilson, electrical contractor, 20, High Street, Bromsgrove. Last day for receiving proofs for dividend January 28th. Trustee, Mr. F. E. Bendall, Midland Chambers, Warwick Passage, Corporation Street, Birmingham.

Company Liquidations

Dulci Electrical Co., Ltd., 742/3, Salisbury House, London Wall, E.C.2.—The first meetings of creditors and shareholders were held on January 11th at Carey Street, W.C., before Mr. H. P. Naunton, Senior Assistant Official Receiver. A statement of affairs was presented showing total liabilities of £7,315 (ranking £7,115), assets nil, issued capital £100 and a total deficiency of £7,215. The company was formed in June, 1933, to carry on business as manufacturers, distributors and retailers of and dealers in gramophones and radio and electrical equipment. Later a refrigerator manufacturing concern was introduced, and it was decided to form a new company to acquire the assets of both businesses. On January 23rd, 1937, the Savoy Refrigerator & Manufacturing Co., Ltd., was incorporated with a nominal capital of £500 to carry on business as refrigerator, radio and electrical manufacturers, and in the following month the goodwill of the refrigerator business, together with the plant and machinery, were sold to that company for £2,500 in shares. In the same month the Dulci Electrical Co. sold its business to the Savoy Co. upon terms whereby the latter would pay the debts of the Dulci Co. and indemnify it against all debts and liabilities. In or about April, 1937, the Dulci Co. obtained an order from radio dealers for one thousand radio chassis and 250 sets costing between £5,000 and £6,000. Premises were taken at 82, Cricklewood Lane in the name of the Savoy Co. The latter company claimed to be a creditor of the Dulci Co. for £3,336 in respect of the balance of moneys paid out on its behalf. Resolutions for voluntary liquidation had been passed by the directors of the Savoy Co. and the liquidator of that company had continued both businesses; the business of the Dulci Co. was eventually closed, having been carried on at a loss. In November, 1937, a creditor obtained judgment against the Dulci Co. for £104 and subsequently filed a winding-up petition. Mr. Barr attributed the insolvency to lack of capital, loss of moneys expended on development work, the failure of radio dealers to pay for and take delivery of sets ordered, and to depreciation in the value of components. Mr. R. L. Binns was appointed liquidator.

Harrow Electric Light & Power Co., Ltd.—Particulars of claims by January 31st to the liquidator, Sir James Devonshire, Northmet House, Southgate, N.14. This is a formal notice. All known creditors have been, or will be, paid in full.

Electricity Supply

Lighting, Domestic, Power

Abertillery.—CHANGE-OVER.—In a few months' time it is expected that the change-over scheme will be completed and the whole of the area will have a.c. Previously only the district of Abertillery was receiving this supply, other parts of the area being served by d.c. generated at the Council's station at Aberbeeg. The whole of the Crumlin area has already been converted, as well as Aberbeeg, and the supply at Llanhilleth is shortly to be changed.

Altrincham.—LINK WITH THE GRID.—A decision has been made by the Altrincham Electric Supply Co. to link up with the grid system.

Annan.—ELECTRIC HEATING.—The Dumfries County Council is to adopt electricity for heating Annan Academy. The cost is estimated at £1,780.

Barnsley.—LOANS.—The Electricity Committee is seeking sanction to borrow £4,770 for mains and sub-station equipment and £5,000 for apparatus.

Barnstaple.—PROPOSED PLANT EXTENSIONS.—A scheme put forward by the electrical engineer (Mr. J. W. Cook) for further extending and modernising the Corporation's generating station at a cost estimated to be in the region of £100,000 is to be placed before the Electricity Commissioners.

Birkenhead.—STREET LIGHTING.—The main roads on the Vyner Road housing estate are to be lighted by 500-W gas-filled lamps at a cost of £392 and the service roads by 100-W lamps (£198).

Bradford.—NEW CONTROL ROOM.—The Electricity Committee is to erect a new control room for the Valley Road power station at a cost of £6,560.

Bristol.—HOUSE SERVICES.—Sanction is being sought by the Electricity Committee to borrow £180,000 for house services.

Burham (Kent).—SUPPLY ARRANGEMENTS.—The Kent Electric Power Co. has informed the Parish Council that electricity will be brought to the village during 1938.

Burton-on-Trent.—EXTENSION.—The Electricity Committee is to afford a supply to Catton Hall and other premises at a cost of £1,250.

Canterbury.—STREET LIGHTING.—The City Council proposes to purchase the experimental mercury electric-discharge lighting system installed in London Road.

Cardiff.—ACQUISITION OF PENARTH UNDERTAKING.—Arrangements have been made at Penarth for the Cardiff Corporation to take over the electricity undertaking, and all that now remains is for the Corporation to promote a Bill in Parliament for the purpose.

Carlisle.—SPECIAL FLAT RATE.—The City Council has decided to fix a flat rate of ¾d. per kWh for electricity for cooking and water heating in all cases where the domestic rate is not applicable.

Chatham.—STREET LIGHTING.—Thirty additional street lamps are to be erected.

Croydon.—INDOOR BOWLING GREEN LIGHTING.—Indoor bowling greens are becoming increasingly popular throughout the country, and although it is not yet possible to provide a surface to equal Cumberland turf a good game can be played on the substitutes now available. In most clubs and public greens the largest number of players attend in the evening and it is therefore essential that the artificial lighting shall approach as close as possible to daylight conditions. Siemens Electric Lamps and Supplies, Ltd., are using their combination of a tungsten filament and a mercury vapour tube in the same outer bulb (the "Sieray-Dual" lamp) for such installations. The first example was the lighting of the Richmond Bowling Club's indoor green, and now the Croydon Bowling Club has installed these lamps in its new indoor section. The lighting at Croydon consists of twenty-seven 300-W lamps in special reflectors, and the accompanying photograph shows the result obtained. Owing to the large amount of steelwork in the roof structure several tests had to be carried out so that the reflectors could be placed symmetrically and at the same time avoid objectionable shadows. The wiring installation was carried out by J. & T. Robinson, Croydon.

The illuminated Croydon bowling green

LIGHTING.—The Corporation has obtained sanction to borrow £41,645 for public lighting.

Dartford.—SUPPLY TO PAPER MILLS.—The Corporation is to afford a supply of electricity to the London Paper Mills at an estimated cost of £1,879.

NEW FEEDER CABLE.—A new 11,000-V feeder cable is to be laid from the electricity works to the Temple Hill kiosk.

Deal.—ELECTRICITY AND COUNCIL HOUSES.—The question of supplying electricity to Council houses in the district has been raised, a suggestion being that the Council might arrange a small loan for the purpose and increase the rents by 3d. a week for a limited period.

East Ham.—MAINS.—Permission is being sought to borrow £20,000 for mains extensions.

Epping Green.—SUPPLY SCHEME.—The County of London Electricity Supply Co. hopes to provide a supply of electricity in the area within the next six weeks.

Eyam Woodlands (Grindleford).—ELECTRIC LIGHTING.—The Parish Council has decided to light the village by electricity.

Fleetwood.—BETTER LIGHTING.—Experiments are being carried out with a view to improving the lighting of the whole town.

Fort William.—ACQUISITION OF ELECTRICITY UNDERTAKING.—The Town Council has received confirmation from the Electricity Commissioners of the Fort William Electricity Special Order, empowering the Council to take over the electricity undertaking from the Fort William Electric Lighting Co., Ltd., and to become authorised distributors of electricity in the town and district. The Town Council will purchase electricity in bulk from the Lochaber power station of the North British Aluminium Co.

Gt. Yarmouth.—OFF-PEAK TARIFF.—Arrangements have been concluded between the Health Committee and the borough electrical engineer for a supply of electricity for all heating purposes at the Isolation Hospital at the price of 0.33d. per kWh between the hours of 8 p.m. and 8 a.m., assuming a total consumption of not less than 100,000 kWh per annum.

LOANS.—The Town Council has received sanction from the Electricity Commissioners to the borrowing of £5,470 for mains and sub-station equipment for supplying electricity to the North Denes estate, and £3,986 for the installation of additional plant required in connection with the supply to Lowestoft.

Halifax.—SUB-STATION.—The Town Council is to build a sub-station in Upper Washer Lane.

Harleston.—LIGHTING CONTRACT.—The Council has made a contract with the East Anglian Electric Supply Co. for street lighting for seven years.

Hastings.—DISTRIBUTION PROJECTS.—Supply extensions are to be carried out to estates at Battle. On one of these, the Stream Farm estate, 208 houses are to be built. A sum of £1,900 is to be spent on improving the supply to Camber and Broomhill, and the Electricity Committee has also concluded arrangements with Arthur Guinness, Son & Co., Ltd., for an additional supply to Ockham Farm and to Udiam Farm, Ewhurst, at an estimated cost of £1,620. The borough water engineer proposes to use electricity for driving the compressors and for cutting the tunnels and supplying motive power to the derrick crane in connection with the construction of the dam at Mountfield and the aqueduct from Mountfield to the Brede Waterworks. The cost of extending the mains is £850.

India.—NEW POWER SCHEMES.—The Maharajah of Mysore recently laid the foundation-stone of the Shimsha hydro-electric project which marks the beginning of a second epoch in the history of hydro-electric power in Mysore. The Department, as His Highness stated, was under an obligation to supply approximately 12,000 h.p. in excess of the Sivasamudram station. The Shimsha site was ideal and the permanent water supply would come from the River Shimsha on which a dam would be constructed near Hagalhalli to impound the waste and seepage waters from the lands irrigated by the Irwin Canal. A communiqué issued by the Madras Government, after reviewing the progress made so far with the Pykara and Mettur hydro-electric projects, states that action will be taken at an early date on the report submitted a few days ago by the Investigation Committee on the Papanasam project. This scheme proposes the development of power from the Tambraparni River in the Tinnevelly district with the aid of a reservoir constructed near Papanasam. The estimated cost is Rs. 2½ crores, and when the scheme is completed it will meet the requirements of the Madura, Ramnad and Tinnevelly districts. Another scheme is connected with

the Ceded Districts, for lifting water for irrigation by electric pumping. A rough hydro-geological survey was made, and tests with pumps are in progress; if they prove successful thermal stations will be installed for pumping water. The Ceded Districts frequently suffer from famine conditions and the provision of bore wells worked by electric power will be a great boon. The Lamisinghi hydro-electric scheme is to be constructed in the Vizagapatam district, but investigations are not complete. The Bezwada thermal station now under construction is intended to co-ordinate electricity supply in the Kistna and Godavari districts.

Inverness.—FORMAL OBJECTIONS TO THE CALEDONIAN BILL.—A decision has been reached by the County Council that opposition to the Caledonian Power Bill shall be merely formal. Most of the Council's objections to the Bill have been satisfactorily met.

Lancaster.—RURAL SUPPLY.—The proposals of the City Council for the laying of underground cables in the parishes of Ellel and Scotforth have been approved by the Rural District Council.

London.—FULHAM.—The Electricity Committee is to provide a supply for 118 flats in Gliddon Road at a cost of £4,279.

The borough electrical engineer reports that the third 60,000-kW turbo-alternator, together with two boilers, was put into commercial operation at the power station on January 1st. This additional installation raises the capacity of the station to 190,000 kW, which brings the classification of the station under the scheme of the National Joint Board into Class K (150,001-200,000 kW). Under Clause 29 of the National Joint Board scheme the new classification will become effective on February 1st, and instructions have been given for the National Joint Board to be informed accordingly. The number of staff engaged on the generation side of the undertaking whose rate of salary is governed by the National Joint Board Schedule is twenty-eight, and in consequence of the reclassification of the station the officers concerned will be entitled to increases varying from a maximum of £42 to a minimum of £20 per annum, the total amount of the increases being £843 per annum.

Manchester.—COAL HANDLING PLANT.—Reporting on the proposals for coal-handling plant costing £24,000 the Electricity Committee states that in July the Committee decided to purchase ground adjacent to the Barton power station for the purpose of increasing the reserve stock of coal by about 50,000 tons. Suitable ground in Bank Street owned by the Department can be utilised for storing about 35,000 tons of coal for the Stuart Street Station. It is impracticable to transport coal between the storage sites and the station bunkers at the rates required without mechanical aid. A coal handling plant scheme has, therefore, been prepared for each station to give, at the lowest possible capital cost, all the facilities necessary. It is proposed that the conveyor system at Barton should be extended by the installation of a new conveyor to transport canal- and rail-borne coal across the railway sidings and Ashburton Road to and from the new storage ground. The coal will be distributed over the ground and reclaimed by means of a drag scraper. The whole of the new plant will be electrically operated, with remote control.

Middlesbrough.—LOAN SANCTIONED.—Sanction has been received by the Town Council to borrow £26,750 for mains and plant in connection with a new 11,000-V network.

Motherwell.—A.C. SUPPLIES.—In consequence of recent industrial changes in certain areas of the burgh on the d.c. system it has been decided that a.c. shall be made available to individual consumers seeking increased supplies.

Northern Ireland.—GENERATION OF ELECTRICITY.—The Ministry of Commerce announces that 68.7 million kWh of electricity was generated by authorised undertakings in Northern Ireland during the quarter ended December 31st, 1937, as compared with 62.0 million kWh in the corresponding quarter of 1936, representing an increase of 6.7 million kWh or 10.8 per cent. During 1937 230.0 million kWh was generated compared with 204.4 million kWh during the previous year, an increase of 25.6 million kWh, or 12.5 per cent.

Nottingham.—LOAN.—Application is being made for permission to borrow £60,500 in connection with certain works at the North Wilford power station.

Petersfield.—OVERHEAD LINE.—The Rural District Council has agreed to the Mid-Southern Utility Co.'s plan for an overhead low-voltage line to serve properties at Farther Common, Hillbrow.

Poland.—POWER PLAN.—It is reported from Paris that the Government of Poland has entered into an agreement with a French industrial group headed by Alsthom for the establishment of a generating station utilising mineral gas in the Polish industrial centre. The initial expenditure is put at 14,000,000 zlotys, rising to a considerably larger sum.

Rushden.—OVERHEAD CABLES.—Permission has been granted to the Northampton Electric Light & Power Co. to erect approximately a mile of overhead line east of Ditchford Lane, an area liable to flooding.

Salford.—HIGH-VOLTAGE LINK.—The Light, Heat and Power Committee has approved in principle a proposal to lay a 33,000-V inter-connecting cable between Salford and Manchester for mutual assistance at an estimated cost to the electricity undertaking of £5,000.

Sandwich.—SUB-STATION.—Plans by the South-East Kent Electric Power Co. for a sub-station at Mill Wall have been approved by the Town Council.

Scarborough.—ELECTRIC PUMPING.—A scheme has been approved for the erection of an electric pumping station at an estimated cost of £4,030.

Spalding.—ELECTRICITY FOR PUMPING.—At a recent meeting of the Rural District Council the terms were reported of an agreement with the Mid Lincolnshire Electric Supply Co., Ltd., for a supply of electricity for a water booster pump to be built at Deeping St. Nicholas.

Stanley (Yorkshire).—ELECTRICITY IN COUNCIL HOUSES.—The Urban District Council is to have 133 Council houses wired for electric lighting.

Swansea.—NEW PLANT.—Sanction is being sought to a loan of £13,604 to cover the cost of switchgear, overhead lines and other plant which will be required to provide the large supply to be taken by the Imperial Magnesium Corporation, Ltd., at works being erected at Port Tennant. The whole of the capital charges will be borne by the company as part of the terms for a pioneer industry's supply, which may rise to much the largest quantity taken by a single consumer.

DEBATE ON UNDERTAKING'S POSITION.—After a lengthy debate on the borough treasurer's abstract of accounts, the Electricity Committee last week decided to adopt the accounts. Reassurances were given by Mr. R. A. Weatherall, borough treasurer, both as to the current losses—which were increased to £20,000 last year—being what were contemplated when the arrangement was made for the Tir John station to be taken over by the Central Electricity Board in 1940, and as to the Corporation's being fully recouped for these by the continuance of the grant for five years beyond that date.

Swindon.—SUPPLY TO HAYDON WICK.—The electrical engineer has been asked to prepare a revised estimate of the cost of making a supply of electricity available at Haydon Wick.

Taunton.—EXTENSION.—The Electricity Committee has decided to proceed with the extension of its supply to Monkton Heathfield.

Todmorden.—LOAN.—Sanction is being sought by the Town Council to a loan of £3,000 for transformers and switchgear.

Warrington.—ELECTRIC-DISCHARGE LIGHTING.—A recommendation of the Lighting Sub-Committee that the extension to Wilson Patten Street should be illuminated by electricity (mercury lamps) was recently approved by the Town Council after some discussion. Alderman J. Poole, chairman of the Gas Committee, moved that the sub-committee should reconsider its decision. He said that it was only by the casting vote of the chairman that the sub-committee gave the lighting to the Electricity Committee. He spoke critically of the colour scheme, observing that they would have green lights sandwiched between red (neon) and white lights. He also suggested that the £66 quoted was not a true competitive cost. Replying on behalf of the sub-committee, Councillor H. Fairclough said that the chairman had not voted previously so that it really was not a casting vote. Alderman Poole had asked if this £66 was an all-in charge. It was. With regard to mixing the colours, it was the intention of the lighting engineer, if he could work it in as opportunity arose, to have all the main roads lighted by mercury lamps.

West Hartlepool.—SUB-STATION.—The North-Eastern Electric Supply Co., Ltd., is to erect sub-stations in Stockton Road and Brenda Road.

Winchelsea (Kent).—PUBLIC LIGHTING.—The Icklesham Council has agreed to install public lighting in Winchelsea, and has arranged for a supply of electricity from the Hastings Corporation.

Traction

Gateshead.—TRAMS AND TROLLEY-BUSES.—The Gateshead and District Tramways Co. has approved a Bill to be promoted on its behalf in Parliament regarding the operation of trams and trolley-buses in the Gateshead area. The Bill is to counter one promoted by the Gateshead Corporation to take over the company's tram system and replace it with trolley-buses. The Newcastle-upon-Tyne Parliamentary Committee has had the Gateshead Corporation's Bill under consideration, and proposes that clauses shall be inserted in the Bill to protect the interests of the Newcastle transport services. It is pointed out that the Newcastle Corporation tramways terminate at the Gateshead ends of the Tyne and High Level bridges and that the Corporation has power, by applying to the Ministry of Transport, to run trolley-buses over the bridge. The Gateshead Council proposes to run trolley-buses from the Gateshead ends of the Tyne and High Level bridges. The report states that there is another clause in the Bill to empower the Gateshead authority to abandon tramways on routes where trolley-buses are to be started, and it is suggested that steps should be taken to safeguard the Newcastle Corporation under its agreement with the Gateshead & District Tramways Co. for the through-running of trams. Similar steps are recommended to be taken as regards the Bill promoted by the Gateshead & District Tramways Co. to replace its trams with trolley-buses.

Germany.—5,000-H.P. LOCOMOTIVES.—The A.E.G. is delivering to the German State Railway forty-four main-line electric locomotives which are to have a short-time rating of over

5,000 h.p. and a maximum capacity of 6,200 h.p. These locomotives will be used mainly on the Nürnberg-Leipzig main line, now being electrified; they weigh 108 tons, and on test one of them has attained a speed of 104 m.p.h. when hauling nine carriages.

London.—NEW UXBRIDGE STATION.—Fresh plans have been decided on by the London Passenger Transport Board for a new railway station, bus station, and shopping centre at Uxbridge. Engineering work has been in progress for some time, but the design of the station has been altered to make it more impressive in appearance and to enable passengers to transfer more easily between buses and trains. A building contract amounting to nearly £100,000 has been signed. The new station will be one of the largest in the Board's system.

Portsmouth.—DEPARTMENT RENAMED.—All the tramway routes have now been converted, and the name of the Tramway Department has accordingly been changed to the Passenger Transport Department. Application has been made for sanction to a supplementary loan of £1,505 to cover excess expenditure on the overhead equipment of the trolley-bus service.

South Shields.—TROLLEY-BUSES.—Application is to be made for sanction to borrow £4,800 for the purchase of another two trolley-buses.

Sunderland.—TRAMS TO BE RETAINED.—The Council has adopted the report by Mr. C. A. Hopkins, the transport manager, advising the Council to retain the existing tram service and not change over to either trolley-buses or motor vehicles for some years to come.

Switzerland.—RAILWAY ELECTRIFICATION.—The only line electrified during 1937 on the Swiss Federal system was the short length from Sonceboz to Court; a landslide prevented the proposed extension on to Moutier. Proposals to electrify the Swiss South-Eastern Railway from Arth-Goldau to Lake Zürich have been sanctioned.

Tyneside.—PROGRESS OF RAILWAY ELECTRIFICATION SCHEME.—The completion of the £500,000 scheme which the directors of the L.N.E.R. approved in 1935 for the electrified lines in the Tyneside area is within sight. The whole of the track equipment on the existing electrified lines between Newcastle and the coastal towns of Tynemouth, Whitley Bay, and Cullercoats, together with the loop line known as the Riverside Branch, has been modernised, and delivery has now been taken of the new rolling stock; 132 new vehicles have been provided. The new electrified service was inaugurated on January 3rd, and big reductions have been made in the times for various journeys. The stopping trains from Newcastle to Newcastle *via* Tynemouth have had their time for the round journey reduced from 63 to 53 minutes, and the hourly expresses from Newcastle to Tynemouth *via* Backworth take 24 instead of 30 min. On the Riverside branch 2 min. is cut from the times of the Newcastle to Tynemouth trains, and 3 min. from those of trains in the reverse direction. The new carriages, which are of steel construction, set an entirely new standard in comfort for suburban passengers; they are finished externally in red and cream, which has had the effect of brightening their appearance considerably. The extension of the electrification from Newcastle to South Shields is proceeding rapidly. The third rail has been electrified, and leakage, continuity, bonding, and other tests have taken place. Eight-coach electric train sets have been run over the line for trial purposes. It is hoped to introduce the full service between Newcastle and South Shields in the early months of this year, with a resultant reduction of the journey time from 33 or 34 min. to 27 min.

Communications

Great Britain.—RADIO LICENCES.—The approximate number of radio receiving licences in force at the end of last year was 8,479,600, against 7,956,721 at the close of 1936, an increase of 522,879.

HIGH-POWER TRANSMITTERS.—The B.B.C. announces that contracts have been placed for the provision of two further high-power short-wave transmitters at the Empire station at Daventry, and for the necessary plant and auxiliary equipment. An extension to the building to house the new transmitters is already in hand. These developments at Daventry are in connection with the foreign language broadcasts.

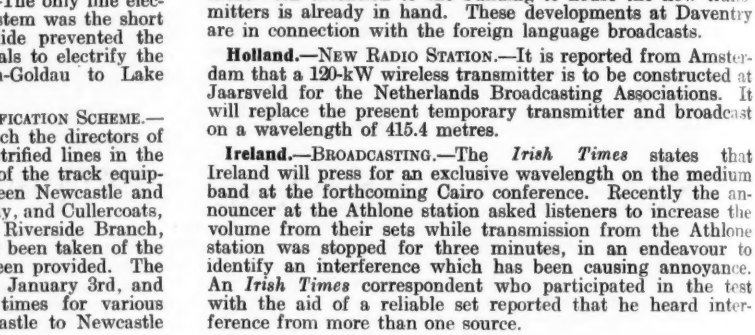
Holland.—NEW RADIO STATION.—It is reported from Amsterdam that a 120-kW wireless transmitter is to be constructed at Jaarsveld for the Netherlands Broadcasting Associations. It will replace the present temporary transmitter and broadcast on a wavelength of 415.4 metres.

Ireland.—BROADCASTING.—The *Irish Times* states that Ireland will press for an exclusive wavelength on the medium band at the forthcoming Cairo conference. Recently the announcer at the Athlone station asked listeners to increase the volume from their sets while transmission from the Athlone station was stopped for three minutes, in an endeavour to identify an interference which has been causing annoyance. An *Irish Times* correspondent who participated in the test with the aid of a reliable set reported that he heard interference from more than one source.

Battery Locomotives for the L.P.T.B.

THE London Passenger Transport Board has recently taken delivery of the first of nine battery locomotives for use on new works and track maintenance. Its estimated weight is 54½ tons and it is 54 ft. 4¼ in. long over coupler faces. The length of the bogie wheelbase is 7 ft. There are four traction motors, each with a one-hour rating of 150 h.p. at 300 V.

The battery (D.P. Battery Co., Ltd.) consists of 160 cells and weighs 13 tons. Its capacity is 768 Ah at the five-hour rate. Three of the nine locomotives are being equipped with Metadyne control by the Metropolitan-Vickers Electrical Co., Ltd., and six with G.E.C. resistance control and a series, series parallel, parallel motor combination. In the case of the Metadyne locomotives the charging current is 200 A until the voltage per cell is 2.4. A potential relay then operates, reducing the rate to 70 A. The Gloucester Railway Carriage and Wagon Co., Ltd., is responsible for the construction of the frames and bodies, and assembly.



A battery locomotive equipped with Metadyne control

For plate-laying the loads involved are: Five railcars, 95 tons empty and 129 tons loaded; and two 30-ton flats, 35 tons empty and 71 tons loaded. Two locomotives in multiple will propel the train from a depôt to the working site, which may be 4¾ miles away. In one case the total fall from the depôt to the working site is 174 ft., with a maximum gradient of 1 in 40 and a general gradient of 1 in 50 and 1 in 61 over 1½ miles. In a second case there is a rise of 30 ft. between the depôt and the working site, the distance being 4½ miles. When at the site the locomotive will inch forward, propelling the train, under the worst conditions on a rising gradient of 1 in 30 on a track in which one sleeper may be ½ in. above or below its neighbours and with irregular curvature and cross level. Liberal allowance has been made for the very adverse conditions, to which should be added a wet track tending to produce minimum adhesion.

For current-rail laying the trailing load for two locomotives will be 200 tons and the distance to be covered without interference to existing traffic between depôt and working site may extend to seven miles. When at the site the locomotives will propel the train forward forty-four times over 60 ft. distance, unloading material at the end of each forward movement. The return to the depôt will be made with a trailing load of 100 tons. The whole of this work will be carried out with energy supplied by the batteries and may last 12 hr.

For cable laying, in order that cables may be laid with safety single locomotives will haul trains of 100 tons trailing load at speeds of about 3 m.p.h. This requirement is fulfilled without paralleling sections of the battery.

When used for normal maintenance work on the permanent way, two locomotives will haul a 250-ton trailing load at a balancing speed of 30 m.p.h. on a level track when fed from conductor rails with a voltage of 600 between positive and negative, and 15 m.p.h. minimum when the source of energy is the battery. The train will, in general, be hauled from the depôt to the point at which work will commence with current supplied from the track. The work when operating on the battery may be taken to be equivalent to 60½ mile cycles with current on up to the moment of braking.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Australia.—February 16th. State Rivers and Water Supply Commission. One 1,100-kW alternator and switchgear and one 600-h.p. motor starter and switchboard. (T.Y. 32222/37.)*
February 1st. Deputy Director Posts and Telegraphs. Switches. (T. 32200/37.)*

Blackpool.—January 24th. Corporation. Stores, materials, &c., for one year. (January 7th.)
January 22nd. One electrically driven drum-type screen and accessories for Manchester Square pumping station. Borough Engineer, Municipal Offices, Talbot Square (deposit £1).
January 29th. One electrically driven drum-type screen and accessories for Lennox Gate pumping station. Borough engineer, Municipal Offices, Talbot Square (deposit £1).

Bristol.—January 31st. Electricity Department. 6.6-kV and 11-kV switchgear. L.v. sub-station switchgear. (January 14th.)
February 7th. 6.6-kV and 11-kV transformers. (See this issue.)

Burnley.—February 5th. Electricity Department. One polyphase meter testing set. (See this issue.)

Cardiff.—February 4th. R.D.C. Electricity Department. Stores for twelve months. (See this issue.)
February 14th. Electricity Department. Meters and cables for one year. (See this issue.)

Dalkeith.—January 24th. Town Council. Electrical work at block of twelve three-apartment houses and shop at Back Street. Morham & Brotchie, 29, Hanover Street, Edinburgh.

Erith.—February 7th. Electricity Department. Stores for twelve months. (January 14th.)

Hastings.—January 27th. Electricity Department. Stores for one and two years. (January 7th.)

Heston and Isleworth.—January 29th. Electricity Department. Kiosk, switchgear and transformer. Stores for one year. (January 14th.)

Horsham.—January 25th. R.D.C. Two electrically driven 5,000 gal. per hr. booster pump sets, complete with all electrical equipment. Clerk to the Council, North Street (deposit £2 2s.).

Kettering.—February 1st. Electricity Department. One polyphase meter-testing set. (January 7th.)

Kingston-upon-Thames.—February 7th. Electricity Department. Stores for twelve months. (See this issue.)

Kirkcaldy.—February 7th. Electricity Department. Fixed fire fighting plant and protective work for generating station. (January 14th.)

Kirriemuir.—January 28th. Town Council. Electric lighting installations in 35 houses. Lowe & Barrie, Bank Street (deposit £1 1s.).

Leeds.—February 19th. Electricity Department. 3-phase switchgear for Whitehall Road generating station. (See this issue.)

Leicester.—February 4th. City Council. One 6,300-V switchboard. (See this issue.)

London.—BETHNAL GREEN.—January 28th. Borough Council. Stores. (January 7th.)
HACKNEY.—January 26th. Electricity Department. Stores for one year. (January 7th.)
ISLINGTON.—January 26th. Electricity Department. Cookers, water heaters and wash boilers for one year. (January 7th.)
HAMMERSMITH.—January 26th. Borough Council. Electrical supplies for twelve months. (January 7th.)
BATTERSEA.—February 9th. Borough Council. Stores and materials for one year. (January 14th.)
H.M. OFFICE OF WORKS.—February 4th. Installation of electric lighting and power at Staffordshire House, Store Street, W.C. (See this issue.)

Manchester.—February 7th. Waterworks Committee. Plant at Longford Bridge, Stretford: Four sets of electrically driven vertical spindle centrifugal pumps. Two 200-kW mercury arc rectifiers with transformers, and one 20-kVA auxiliary transformer. Deputy engineer, Waterworks Offices, Town Hall (deposit £1 1s.).
February 2nd. Electricity Committee. Cookers for twelve months. (See this issue.)

Newcastle-on-Tyne.—February 8th. Health Committee. Two sets of deep therapy X-ray apparatus. (See this issue.)

New Zealand.—WELLINGTON.—March 15th. Public Works Supplies and Tenders Committee. Six 5,500-kVA, single-phase transformers and accessories. (T. 32329/37.)*
February 22nd. Public Works Department. Three 25-kVA transformers for Arapuni. (T.Y. 32332/37.)*
March 1st. Insulators. (T.Y. 32335/37.)*

Northern Ireland.—BELFAST.—January 21st. Electricity Department. Stores for twelve months. (January 7th.)

Plymouth.—February 5th. Electricity Department. Meters, time switches, underground cables and joint boxes. (See this issue.)

Preston.—January 29th. Corporation. Two 3½-ton electric level luffing portal quay cranes for Albert Edward Dock. Town Clerk, Municipal Building.

South Africa.—UMTATA.—March 24th. Municipality. Two 200-kW, three-phase alternators, direct-coupled to heavy oil engines, 3,300-V switchgear, accessories, &c. (T. 16020/38.)*
PRETORIA.—February 10th. Union Tenders and Supplies Board. Two motor generator sets. (T.Y. 16017/38.)*
Cables. (T. 16235/38.)*
February 17th. One 250-V, d.c. electric copying machine. (T. 16016/38.)*

Southend-on-Sea.—February 3rd. Electricity Department. Stores for one year. (January 14th.)

Stoke-on-Trent.—February 1st. North-West Midlands J.E.A. Electric kettles and irons. (January 14th.)
February 2nd. Painting chimney stacks and spraying cooling towers. (See this issue.)
February 9th. Electrical Engineers' Department. Stores for twelve months. (See this issue.)

Swansea.—February 1st. Electricity Department. Stores for twelve months. (January 14th.)

Torquay.—February 4th. Corporation. Electric lamps, &c., for twelve months. Town clerk.
February 5th. Electricity Undertaking. Cables. (See this issue.)

Walsall.—January 24th. Corporation. Two sets of horizontal-spindle electrically driven centrifugal pumps for screened sewage, with automatic switchgear. Town Clerk, Council House (deposit £1 1s.).

Wednesbury.—February 12th. Borough Council. Installation of electric wiring and fittings in 310 houses in Crankall Lane and Park Lane, and also four houses and shops. A. Booth, borough architect and surveyor.

West Ham.—March 4th. Electrical installation at Whipps Cross Hospital, E.11. (January 7th.)

Wimbledon.—February 4th. Electricity Department. Transformers. (See this issue.)
February 7th. Three 11,000-V metal-clad switchboards and l.v. switchgear equipments, with air-break circuit-breakers. (See this issue.)

Winchester.—February 14th. Electricity Department. Underground cables for twelve months. (See this issue.)

Wolverhampton.—February 8th. West Midlands J.E.A. Two-ton electrically operated goods and passenger lift at the Ironbridge power station. Chief engineer and manager, Phœnix Buildings, Dudley Road (deposit £1 1s.).
February 8th. Underground cables. (See this issue.)
February 15th. E.h.v., h.v. and l.v. a.c. cables and l.v. d.c. cables for the Ironbridge generating station. (January 14th.)
February 7th. Education Committee. Electric lighting at Springfield Road Schools extensions. H. B. Robinson, borough engineer, Town Hall (deposit £1 1s.).

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Birkenhead.—Electricity Committee. Accepted. Wiring forty-five houses (£197).—Park Electrical Co. Cables.—Hackbridge Cable Co.; General Cable Manufacturing Co.; Mersey Cable Works; Falk, Stadelmann & Co.

Douglas (I.O.M.).—Electricity Committee. Recommended. Water-tube boiler and accessories (£25,410).—Richardsons, Westgarth-Brown Boveri.

Dover.—Electricity Committee. Accepted. Meter-testing equipment (£395).—Ferranti.

Essex.—Finance Committee. Accepted. Electrical installation at county offices, Chelmsford (£647).—Essex Electric Installations. Telephone installation (£1,866).—Reliance Telephone Co.

Great Yarmouth.—Watch Committee. Accepted. Electrical installation at Gorleston police station (£156).—J. W. Lamb & Sons.
Education Committee. Recommended. Electrical installation at Swindell school extension (£45).—Gray & Palmer.
Electricity Committee. Recommended. Switchgear.—Crompton Parkinson (£1,412); B.T.H. (£114). Kiosk (£365).—Switchgear & Equipment.

Hastings.—Electricity Committee. Recommended. Transformers for twelve months.—Lindley Thompson Transformer and Service Co.; Ferranti.

Hemsworth.—R.D.C. Accepted. Installation of electric lighting in 62 houses on the South Kirkby Estate.—G. Silkstone.

Johnston.—Housing Committee. Accepted. Electric lighting at housing estate (£145).—R. Love and Sons.

Kirkcaldy.—Town Council. Accepted. Electric lighting for the new housing estate at Oswald Road.—Thornton and Markinch Electrical Services.

Lanarkshire.—County Council. Accepted. Electric lighting installation at the new Health Institute, Bellshill (£464).—W. Y. M'Adam.

London.—FULHAM.—Electricity and Lighting Committee. Accepted. Switchgear and battery equipment for Central sub-station (£2,124).—English Electric Co.

Salford.—Town Council. Accepted. Electric lift at the electricity works (£316).—Evans Lifts.

South Shields.—Cleansing Committee. Accepted. Two 2½-ton electric vehicles (£684 each).—Electricars, Ltd.

West Hartlepool.—Town Council. Accepted. Meter-testing equipment for the Electricity Department.—Metro.-Vick. Elecl. Co. One 300-kVA, single-phase, 6,000-V transformer for the Brinkburn Road sub-station.—Electric Construction Co.

West Lothian.—County Council. Accepted. Electric lighting installation in eighty houses at East Whitburn and fifty at Newton.—Greig Bros.

Forthcoming Events

Institution of Electrical Engineers.—Monday, January 24th. Institution, London, W.C.2. 7 p.m. Informal meeting. Discussion on "The Routine Testing of Protective Gear." To be opened by Mr. G. H. Fowler.

Mersey and North Wales (Liverpool) Centre.—Monday, January 24th. The University, Liverpool. 7 p.m. "Safeguards Against Interruptions of Supply." Messrs. H. W. Clothier, B. H. Leeson and H. Leyburn.

North Eastern Centre.—Monday, January 24th. The Newe House, Newcastle-on-Tyne. 6.15 p.m. "Rural Electrification." Mr. J. S. Pickles.

Wednesday, January 26th. Royal Station Hotel, Newcastle-on-Tyne. 7.30 p.m. Annual dinner.

South Midland Centre.—Monday, January 24th. James Watt Memorial Institute, Birmingham. 7 p.m. "The Design of Domestic Electric Cookers." Mr. O. W. Humphreys. "Electric Cookers for Domestic Purposes, with Special Reference to Maintenance Costs." Mr. J. N. Waite.

Friday, January 28th. Midland Institute, Birmingham. 7 p.m. "The Part of the Civil, Mechanical and Electrical Engineer in the Development of Empire Flying Routes" (Joint Meeting with the Institutions of Civil and Mechanical Engineers).

Wireless Section.—Tuesday, January 25th. Institution, London, W.C.2. 6.30 p.m. Informal meeting. Discussion on "Cathode-Ray Tubes for Wireless Purposes." To be opened by Mr. L. H. Bedford.

Scottish Centre.—Tuesday, January 25th. North British Station Hotel, Edinburgh. 7 p.m. "Recent Transformer Developments and Applications." Mr. T. A. Long.

West Wales (Swansea) Sub-Centre.—Thursday, January 27th. Technical College, Swansea. 6.30 p.m. "Recent Progress in Induction Motor Construction." Mr. L. H. A. Carr.

Junior Institution of Engineers.—Friday, January 21st. 39, Victoria Street, London, S.W.1. 7.30 p.m. Informal meeting. Discussion on "Power Station Efficiencies." Mr. R. H. Parsons.

Salford Technical and Engineering Association.—Saturday, January 22nd. Royal Technical College, Salford. 7 p.m. Presidential address followed by a musical social evening.

Electrical Power Engineers' Association (*London Local Group*).—Tuesday, January 25th. Caxton Hall, S.W.1. 7.15 p.m. "Electrical Condensers for H.F. and Power Work." Mr. H. W. Biskeborn.

Northern Division.—Thursday, January 27th. Engineers' Club, Manchester. "Electric Welding: its Application to Electrical Manufacturing." Mr. A. H. Bent.

Electrical Contractors' Association.—Tuesday, January 25th. Savoy Hotel, London, W.C. 6.30 for 7 p.m. Annual dinner.

Institution of Electronics (Inc.).—Tuesday, January 25th. 75, Gloucester Place, London, W.1. 7.30 p.m. "Aerials and Short Wave Reception." Mr. G. T. Clack.

Association of Supervising Electrical Engineers.—Tuesday, January 25th. City Electricity Department, Whitehall Road, Leeds, 1. 7.15 p.m. Illustrated lecture on "Modern Arc Welding Developments and Technique." Mr. R. M. Gooderham.

Thursday, January, 27th. Aldwych House, London, W.C.2. 6.45 p.m. Informal meeting. "Construction of Switchgear." Mr. W. D. Murray.

Thursday, January 27th. Royal Star Hotel, Maidstone. 7.15 p.m. Illustrated lecture on "Electricity in Agriculture and Horticulture." Mr. F. E. Rowland.

Batti-Wallahs' Society.—Thursday, January 27th. Hotel Victoria. 12.30 for 12.55 p.m. Luncheon. Lord Sempill speaking on "Commercial Aviation as a World Force."

Electrical Trades' Commercial Travellers' Association.—Friday, January 28th. Connaught Rooms, Great Queen Street, W.C.2. 6.30 for 7 p.m. Annual dinner.

Notes

Refrigeration Conference

The British Association of Refrigeration proposes to hold a Refrigeration Conference in the rooms of the Royal Society, London, on July 12th (Tuesday) immediately following a meeting at the same centre of the Technical Commissions of the International Institute of Refrigeration. The subjects provisionally set down for discussion are:—"Influence of Low Temperatures on Enzymes, Vitamins, &c."; "Limitations of Gas Storage"; "Air Conditioning Problems"; "An International Unit of Refrigeration"; and "Standard Tables Giving the Properties of Refrigerants." The meeting of the seven Commissions of the Technical Board of the International Institute of Refrigeration, and also a general assembly of the Commissions, have been convened for July 11th. Mr. Gardner Poole, President of the Technical Board, will preside over the General Assembly. Sir Frank Smith will deliver an address opening the Conference, over which Dr. Ezer Griffiths, president of the British Association of Refrigeration, and Mr. A. R. T. Woods, past-president, will preside. Admission will be free, but applications should be sent to the British Association of Refrigeration, Empire House, St. Martin's-le-Grand, London, E.C.1. A short series of excursions has been arranged for the days following the meeting.

Radio Interference

A definition of permissible limits of electrical interference with broadcast reception has been prepared as a British Standard Specification (No. 800: British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s.). It is understood that the Specification has been issued with the approval of such important bodies as the Post Office, the I.E.E., the National Physical Laboratory, the B.B.C., and the Radio Manufacturers' Association. The Specification should be of special interest to manufacturers of electrical equipment likely to cause interference, and it is hoped that much will be done, as a result of this Specification, in the way of voluntary suppression of interference even before the proposed legislation on the subject is introduced.

Mining Electrical Engineers

The annual conference of the Association of Mining Electrical Engineers is to be held in Glasgow from June 7th to 10th. The conference headquarters will be the Royal Hotel and the annual dinner and dance will take place at the Central Hotel.

Faraday House Old Students

The annual dance of Faraday House Old Students' Association will be held on February 8th at the Hotel Great Central, Wharncliffe Rooms. Tickets (7s. 6d. single, 15s. double) can be obtained from the Rev. L. Van Vestrant, hon secretary, Faraday House, 66, Southampton Row, W.C.1.

East Midland Electrical Power Engineers' Dinner

The annual dinner of the No. 7 East Midland Area was held at Nottingham on January 15th. About 150 attended, and Mr. S. Beeson (Nottingham), vice-chairman of the Area, presided in the absence through indisposition of the chairman, Mr. A. P. Hayes. The toast of "The City of Nottingham" was proposed by Mr. W. A. Jones (general secretary) and acknowledged by Ald. E. Huntsman (chairman, Nottingham Corporation Electricity Committee). In submitting the toast of "The E.P.E.A." Mr. J. Mould (city electrical engineer and general manager, Leicester) said that it had a marvellous record. He recalled its early struggles with regard to the salary schedule. Never in recent times had there been the risk of a serious rupture between the E.P.E.A. and the employers. Mr. H. J. Cox (Birmingham), president, who replied, said that a few weeks ago a dinner was held in London at which the employé members of the National Joint Board and the National Joint Industrial Council were entertained by the employers of the two bodies. He could not help contrasting the spirit which was evident at that dinner with the early days of the Association when meetings were held secretly. During the evening presentations were made to the recently retired Area secretary, Mr. A. Marsh, and the assistant secretary, Mr. H. Bamford, both of Derby. Mr. Marsh received an electric clock and a standard lamp and Mr. Bamford an electric clock. The present Area secretary is Mr. H. E. Munday, and the assistant secretary Mr. J. C. P. Llewellyn, both of Burton-on-Trent.

E.I.B.A. Ball at Nottingham

The annual ball of the Nottingham Branch of the Electrical Industries Benevolent Association was held last week and was attended by 400 people. The evening's festivities began with supper, after which there was dancing and a whist drive for the non-dancers. Mr. E. P. Prior, chairman of the Nottingham Branch, presided at supper and the guests included the Lord Mayor and Lady Mayoress of Nottingham (Councillor W. Hooley and Miss Sylvia Hooley), Ald. E. Huntsman (chairman of the Corporation Electricity Committee), Mr. A. D. Phillips (Derby and Notts Power Co.), and Mr. H. Senior Fothergill (general secretary of the E.I.B.A.). The Lady Mayoress presented the prizes. The local branch (secretary, Mr. R. B. Baggaley) usually forwards £100 to the Association as the result of the year's efforts which culminate in the annual ball.

Students' Dance

On Friday last the students of the Institutions of Electrical, Civil and Mechanical Engineers held their annual dance at the Victoria Halls, Southampton Row, W.C. Once again this popular function attracted large numbers and the two halls were required to accommodate them. As in previous years the whole affair was delightfully informal, and its success was in no small measure due to Mr. A. H. Young, the hon. assistant secretary for entertainments of the I.E.E. London Students' Section.

Appointments Vacant

Mains assistant for Blackpool Electricity Department.

Mains assistant for Darwen Electricity Department.

Power station technical assistant for Salford Electricity Department.

Electrical draughtsman for Woolwich Electricity Department.

Assistant, Grade II, for the Royal Aircraft Establishment, South Farnborough.

Meter tester for the Trent Valley and High Peak Electricity Co., Ltd.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

MAVA electric cells

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. R. C. Pierce, for twenty-nine years general manager and engineer of the Cambridge Electric Supply Company, has retired from that post and has been elected to a seat on the board.

Mr. P. Bregazzi, of Douglas (I. of M.), has been appointed by the Ashton-under-Lyne Town Council to succeed Mr. J. L. Ogden as electrical engineer and manager of the electricity undertaking.

In the report of the Plymouth Corporation Electricity Department dinner in our last issue we mentioned that **Miss E. M. Edwards,** demonstrator with the electricity undertaking, was presented with the Elizabeth Sloan Chesser cup, which is given to the candidate receiving the highest percentage of marks when qualifying for the diploma of the Electrical Association for Women. This is the initial year of the competition, and we now reproduce a photograph showing the presentation to Miss Edwards by Councillor Mrs. C. H. Daymond, acting president of the local branch of the E.A.W.

The presentation of the Elizabeth Sloan Chesser Cup, showing (left to right) Mr. H. Midgley (city electrical engineer, Plymouth), Miss E. M. Edwards (the winner), Councillor Mr. F. Leatherby (chairman of the Electricity Committee), Councillor Mrs. C. H. Daymond, and Councillor Mrs. J. Pook

Mr. H. A. Rees, hon. secretary of the North Wales Branch of the Association of Mining Electrical Engineers, has resigned from that position and is leaving shortly to take up a post in West Africa. **Mr. H. G. Jones** has been appointed to succeed him.

Mr. C. H. Hodgson, A.M.C.T., has been appointed assistant sales manager to Rotunda, Ltd., in connection with the company's "Slipknot" insulating tapes. Mr. Hodgson was previously in the sales office of the Chloride Electrical Storage Co., Ltd. He commenced his new duties on January 3rd, and will work under the direct supervision of Mr. J. A. Whitehead, the sales manager of Rotunda, Ltd.

[*Jerome*

Mr. C. H. Hodgson

Mr. P. MacKenzie, lines engineer with the Grampian Electricity Supply Co., Ltd., at Forfar, has taken up a position at Stranraer with the Wigtownshire Electricity Company.

Mr. P. F. Bennett, O.B.E., has been nominated by the Grand Council of the Federation of British Industries as president-elect of the Federation. Mr. Bennett, who is chairman and managing director of Joseph Lucas, Ltd., has long taken a leading part in the work of the Federation, and during the past year he has been assisting the president, Lord Hirst, as deputy president. He has also been for many years chairman of the Birmingham District Committee of the Federation. He has been closely associated with the work of the Empire Committee, and he attended the Ottawa Conference. He is a member of the Grand Council, the Executive Committee and other committees, and has recently been appointed to preside over the Special Committee which is considering the question of the location of industry. He is a past-president of the Society of Motor Manufacturers and Traders.

Mr. W. B. D. Paul, mains superintendent to the West Hartlepool Town Council, has been appointed sub-station superintendent in succession to Mr. H. Rendle, who has retired.

Monsieur H. Milon, honorary director of the French Posts, Telegraphs and Telephones, and a past-president of the Société Francaise des Electriciens, has been elected president of the French Union des Syndicats de l'Electricité in succession to the late Monsieur H. Cahen.

Mr. A. Watson, of Hackney, has been appointed by the Aberystwyth Corporation Electricity Committee as mains assistant, at a salary of £400 per annum.

Mr. H. Peters, hon. secretary and treasurer of the Yorkshire Area Committee of the E.I.B.A., asks us to say that E.I.B.A. communications concerning the Yorkshire area should be sent to him at 46, Wellington Street, Leeds, 1.

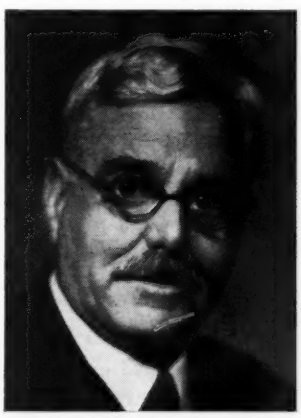
Mr. J. H. Gyles, city electrical engineer of Durban, who has been elected president of the Association of Municipal Electricity Undertakings of South Africa and Rhodesia

Mr. L. C. Morrison has resigned from the board of Kolster-Brandes, Ltd.

Mr. K. A. Scott-Moncrieff has retired from the chairmanship of the Electric Supply Corporation, but will continue as a director of the company and of the Hendon Electric Supply Co. **Mr. A. J. Fippard** has been appointed chairman of the Corporation and has joined the boards of the five subsidiaries in Sussex and that of the Peterhead Electricity Co.

We tender our congratulations to **Mr. M. J. Railing,** vice-chairman and joint managing director of the General Electric Co., Ltd., who was a member of the curling team which won the Philadelphia Cup on Tuesday last on the rinks of the St. Moritz Curling Club.

Mr. E. J. Pond, Midland district superintendent of W. T. Henley's Telegraph Works, Co., Ltd., retired from that position on December 31st after thirty-seven years' service with the company. Originally he represented Henley's in the Midland Counties, Eastern Counties, North Wales and the Isle of Man, but as electrical development increased and additional branches were opened the area covered by Mr. Pond was eventually restricted to the Midland Counties. From the company's branch in Birmingham he then worked all the Midland counties, and when branches were opened at Nottingham and Bedford he was appointed Midland district superintendent. On January 8th a dinner was given in his honour at the Queen's Hotel, Birmingham, by the combined staffs of the Birmingham, Nottingham and Bedford branches and the Henley Tyre Co.'s staff for those areas. A presentation of an inscribed silver tray was made to him. He has also received a grandfather clock from the staffs of Henley's head office, Gravesend and North Woolwich works, and the company's branches in all parts of the country.



[*H. J. Whitlock & Sons*

Mr. E. J. Pond

Obituary

Mr. R. W. Edwards.—We regret to record the death of Mr. Reginald William Edwards, chairman of the Mid Southern Utility Co., which occurred on January 15th at the age of sixty-six years. Mr. Edwards joined the old Aldershot Gas &

Water Co. in 1899, and was appointed general manager in 1905. He retired from the general managership in 1917, and was elected to the board and appointed managing director in 1917, being elected chairman two years later. Mr. Edwards piloted through Parliament a large number of Private Bills and Orders relating to the company and its activities, including in 1909 a Bill empowering the company to generate and distribute electricity. By the Act of 1931 the company was empowered to invest in other similar undertakings and Associated Utilities, Ltd., was formed as a holding company in 1933 with Mr. Edwards as chairman and managing director. The holding company controls a number of electricity and gas undertakings.

Mr. J. E. Stewart.—The death occurred on January 13th, at the age of seventy-two, of Mr. John Edwin Stewart, M.Inst.C.E., M.I.E.E. Mr. Stewart was at one time with the Derby Corporation and later joined the St. Lawrence Power Co. and the Kettle River Power Co. From there he went to South America and was engaged on construction work with the Anglo-Argentine Tramways Co., La Plata Tramways and the Buenos Aires Electric Tramways. He became an associate member of the I.E.E. in 1891, and full member in 1898.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Philips Blackburn Works, Ltd.—Private company. Registered January 13th. Nominal capital, £50,000. Objects: To carry on the business of electrical, mechanical and general engineers, manufacturers of, dealers in and agents for electric lamps, electric-discharge tubes, electric signs, X-ray and medical apparatus, electric household and domestic appliances, electrical measuring and testing apparatus, manufacturers of and dealers in apparatus, appliances and devices for recording and reproducing sound, speech, music, signals, pictures or scenes, including all forms and methods of cinematography, television, wired and wireless radio, &c. The subscribers are: C. F. Cogwell, 145, Charing Cross Road, W.C.2; and L. G. Mason, 32, Felstead Road, Orpington, Kent. Secretary: C. F. Cogwell. Registered office: Spencer House, South Place, E.C.

Venetian Fires, Ltd.—Private company. Registered January 5th. Capital, £10,000. Objects: To carry on the business of manufacturers of and dealers in electric fires, stoves, radiators, heaters, ovens, cookers, refrigerators, &c. The directors are: J. A. Gatti, 10, Maiden Lane, Strand, W.C.2, and S. G. Gatti, 26, South Side, Streatham Common, S.W.16. Solicitors: Slaughter & May, 18, Austin Friars, E.C.2.

F. C. Lock, Ltd.—Private company. Registered January 13th. Capital, £1,000. Objects: To carry on the business of radio service agents, &c. The subscribers are: J. W. Stratton, 34, Chiltern Drive, Surbiton; F. C. Lock, 39, Tolworth Rise, Surbiton; and C. H. Coates, 23, Kingsmead Avenue, Worcester Park. F. C. Lock is first director. Registered office: Mandarin House, 69, High Street, Walton-on-Thames, Surrey.

Portelec Vulcanising, Ltd.—Private company. Registered January 14th. Capital, £100. Objects: To carry on the business of electric vulcanisers, manufacturers and suppliers, &c. The directors are: L. W. Bindon, 1, Onslow Road, Wallasey, Ches., and two others. Registered office: 24, North John Street, Liverpool.

A. & H. Radio, Ltd.—Private company. Registered December 29th. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in radio and electrical goods and appliances, gramophone sets and accessories, &c. The subscribers are: A. J. V. Ramage, 29, Comeragh Road, W.14; and A. Wilson, 62, Myddelton Square, E.C.1. Solicitors: Zefferti & Heard, 17, Coleman Street, E.C.2.

H. W. Holland, Ltd.—Private company. Registered January 5th. Capital, £2,000. Objects: To carry on the business of manufacturers of and dealers in hardware and ironmongery of all kinds, including electrical supplies, engineers' stock and sundries, &c. The directors are: W. H. Holland, 105, Midland Road, Bedford, J. H. Coxan, 84, Rosamond Road, Bedford, and K. G. Holland, 105, Midland Road, Bedford. Secretary: W. H. Holland. Registered office: National Provincial Bank Chambers, 17, St. Paul's Square, Bedford.

Robinsons (Radio Engineers), Ltd.—Private company. Registered January 12th. Capital, £500. Objects: To carry on business as manufacturers of and dealers in radio and television sets and apparatus, &c. The directors are: C. T. Plant, Old Bank House, Irongate, Derby; and E. G. Robinson, Jesmond, Siddal Lane, Allestree, Derby.

Returns of Electrical Companies

Barlow-Whitney, Ltd.—Capital, £5,000 in 2,500 7½ per cent. cumulative preference and 2,500 ordinary shares of £1. Return dated November 2nd, 1937. 350 preference and 1,800 ordinary shares taken up. £1,850 paid on 350 preference and 1,500 ordinary shares. £300 considered as paid on 300 ordinary shares. Mortgages and charges, nil.

F. S. Taieb, Ltd.—The nominal capital has been increased by the addition of £3,000 in £1 6 per cent. preference shares beyond the registered capital of £4,000.

Electro-Horticultural Equipment Co., Ltd.—Three debentures charged on the company's undertaking and property, including uncalled capital, all dated December 23rd, 1937, to secure £125, £150 and £150 respectively. Holders: Associated Electrical Industries, Ltd., Crown House, Aldwych, W.C.2.

Two I.E.E. Dinners

THE annual dinner and dance of the Western Centre of the Institution of Electrical Engineers was held on Monday last at the Royal Hotel, Cardiff, Mr. H. G. Weaver, chairman, presiding.

The toast of the Institution was proposed by the Lord Mayor of Cardiff (Alderman O. C. Purnell), who referred to the origin and history of the Institution and paid tribute to eminent men who were and had been members. He welcomed Sir George Lee and referred to his work as chief engineer of the Post Office and to the developments that had taken place in telephone engineering.

The President of the Institution, Sir George Lee, C.B.E., M.C., said, in responding, that he was glad to hear of the courage with which industry was combating the problem of the Special Areas. Dealing with the I.E.E., he said that each section of the Institution was of equal importance and he wanted to correct the impression that papers read in London were more important than those read at local centres. He concluded with an appeal for greater support for the Institution's Benevolent Fund; of 18,000 members, only 5,000 were regular subscribers.

"Our Guests and Kindred Societies" was proposed by Mr. H. S. Ellis, who welcomed particularly Miss Haslett, of the E.A.W. In replying, Miss Haslett said they were doing all they could in respect of the domestic servant problem, and in many respects they were in the hands of the electrical engineers, to whom they looked to provide even more labour-saving devices.

Mr. J. W. Spark proposed the toast of "The Chairman," and referred to the establishment of a new Centre for Devon and Cornwall. Actually, London had to look to the provinces to provide most of the papers, and he placed great importance upon papers read before the Centres.

There were over 420 members and guests present at the North-Western Centre dinner in Manchester on Tuesday last at which Mr. J. W. Thomas, the chairman, presided. In proposing the toast of the Institution, Mr. B. Mouat Jones, Principal, Manchester College of Technology, referred to the prophecy of Cromwell Varley at the opening meeting of the Institution in 1872 that all matter would be found to be electrical in character. The speaker stated that the membership to date was 17,349. The problem of training engineers was not solved yet, and called for discussion between teachers and practical men.

Sir George Lee, in response, described the primary object of the Institution as education. He considered that the curricula of the universities were not broad enough for the requirements of industry. In ten years the value of extremely specialised knowledge disappeared, and only fundamental and cultural education fitted a man for higher positions. He suggested that in large towns the various engineering societies should combine to own one dignified building. He saw no reason for a slump if there were proper confidence.

The health of the guests was proposed by the chairman, and the Mayor of Salford (Councillor A. Millwood), in replying, urged the need for a more scientific outlook on the part of those responsible for political control all over the world.

Mr. A. L. Lunn proposed the toast of the chairman, and in his response Mr. Thomas thanked Messrs. L. H. A. Carr, honorary secretary, and A. L. Green, assistant secretary, for the success of the dinner.

Switches for Emergency Lighting

For emergency lighting in places of public entertainment, hospitals and other buildings, the switch employed for changing over the whole or part of the main electricity supply to a battery has often been hand operated in the past, particularly in places of public entertainment, as the licensing authorities have not been satisfied that an automatic device would, in fact, operate satisfactorily in the event of the failure of the main electricity supply. With a view to ensuring reliability British Standard Specification No. 764 has been published, and the Home Office, London County Council, and other interested bodies have co-operated in its preparation. It applies to automatic change-over switches or contactors employed in conjunction with storage batteries or other alternative source of supply to provide means of changing the "safety lights" automatically from the normal supply to the alternative source. Copies can be had from the British Standards Institution, 28, Victoria Street, S.W.1 (price 2s. 2d. post free).

Freezer Supplies, Ltd.—Mortgage on land with Stone Bridge Mill thereon at Oswaldtwistle, Lancs, &c., dated December 24th, 1937, to secure all moneys due or to become due from the company to Martins Bank, Ltd.

Hewittic Electric Co., Ltd.—Capital, £50,000 in £1 shares. Return dated August 26th, 1937. 40,000 shares taken up. £40,000 paid. Mortgages and charges, nil. A return of allotments, made up to August 30th, 1937, shows a further 1,400 shares allotted as fully paid.

Boxer Radio Co., Ltd.—Capital, £550 in £1 shares. Return dated November 1st, 1937. All shares taken up. £502 10s. paid (£1 on 500 and 1s. on 50 shares). Mortgages and charges, nil.

H. A. Lee, Ltd.—Capital, £1,500 in £1 shares. Return dated September 20th, 1937. 1,425 shares taken up. £625 paid. £800 considered as paid. Mortgages and charges, nil.

G. A. Nicholas, Ltd.—Capital, £2,000 in £1 shares. Return dated October 29th, 1937. 1,450 shares taken up. £1,450 paid. Mortgages and charges, nil.

Page & Girling, Ltd.—Capital, £2,000 in £1 shares. Return dated December 6th, 1937. All shares taken up. £2,000 paid. Mortgages and charges, nil.

J. & F. Stone Lighting & Radio, Ltd.—Capital, £600,000 in 200,000 6 per cent. preference shares of £1 and 1,600,000 ordinary shares of 5s. Return dated September 22nd, 1937. All shares taken up. £390,000 paid (£1 on 200,000 preference, 5s. on 390,000 ordinary and 2s. 6d. on 740,000 ordinary shares). £117,500 considered as paid on 470,000 ordinary shares. Mortgages and charges, nil.

London Relay Wireless, Ltd.—Capital, £2,500 in £1 shares. Return dated November 2nd, 1937. All shares taken up. £2,500 paid. Mortgages and charges, nil.

Pulford Brothers, Ltd.—P. S. Booth, of 2, Bixteth Street, Liverpool, ceased to act as receiver and/or manager on January 7th, 1938.

Oakham Gas and Electricity Co., Ltd.—Particulars filed of £10,000 debentures authorised July 15th, 1937, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being issued on January 1st, 1938. Satisfaction in full on January 1st, 1938, of series of debentures authorised by resolution dated July 9th, 1927, and registered August 25th, 1927. (According to the register of mortgages, the series of debentures registered August 25th, 1927, originally secured £10,000.)

D. C. Electric Co., Ltd.—Particulars filed of debentures not exceeding £2,640 authorised December 17th, 1937, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £2,640.

Oliver Pell Control, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 20th, 1937, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Morton Industries, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 20th, 1937, to secure £500. Holder: Gwendolen N. Samson, 86, Highlands Heath, Putney, S.W.

Suflex, Ltd.—Satisfaction to the extent of £500 on December 29th, 1937, of two debentures authorised by resolution dated November 6th, 1933, and registered November 7th, 1933.

Magnesium Elektron, Ltd.—Capital, £400,000 in £1 shares. Return dated December 13th, 1937. All shares taken up. £400,000 paid. Mortgages and charges, nil.

Radio Rentals, Ltd.—Capital, £250,000 in 150,000 preference shares of £1 and 400,000 ordinary shares of 5s. Return dated December 8th, 1937. 100,000 preference and 400,000 ordinary shares taken up. £140,000 paid on 100,000 preference and 160,000 ordinary shares. £60,000 considered as paid on 240,000 ordinary shares. Mortgages and charges, nil.

British Relay Wireless, Ltd.—Capital, £5,500 in £1 shares. Return dated November 2nd, 1937. All shares taken up. £5,500 paid. Mortgages and charges, nil.

Bennett & Escott, Ltd.—Capital, £10,000 in 5,000 preference and 5,000 ordinary shares of £1. Return dated December 13th, 1937. 4,200 preference and 4,200 ordinary shares taken up. £8,400 paid. Mortgages and charges, nil.

Home Radio (Lowestoft), Ltd.—Capital, £1,000 in £1 shares. Return dated October 9th, 1937. 928 shares taken up. £928 paid. Mortgages and charges, nil.

Hornby Electrical Supplies Co., Ltd.—Capital, £20,000 in 15,000 preference shares of £1 and 100,000 deferred shares of 1s. Return dated October 25th, 1937. 1,100 preference and 26,000 deferred shares taken up. £2,400 paid. Mortgages and charges, nil.

Ignition and Electrical Services, Ltd.—Capital, £100 in £1 shares. Return dated September 9th, 1937. All shares taken up. £100 paid. Mortgages and charges, nil.

Dunmow Light & Heat Co., Ltd.—Capital, £10,000 in £1 shares. Return dated November 5th, 1937. 7,500 shares taken up. £7,500 paid. Mortgages and charges, £1,500 debentures.

Electricity Services, Ltd.—Capital, £5,000 in £1 shares. Return dated November 12th, 1937. 4,575 shares taken up. £4,515 paid. £60 considered as paid. Mortgages and charges, nil.

Electrical Appliances Investment Co. (Cornwall), Ltd.—Issue on December 29th, 1937, of £600 debentures, part of a series already registered.

Ismay Dirks Appliances, Ltd.—Particulars filed of debentures not exceeding £5,000, authorised December 30th, 1937, charged on the company's property, including uncalled capital, the amount of the present issue being £1,000.

H. Norman Kirk, Ltd.—P. O. Williams, of Bank Buildings, Temple Street, Swansea, ceased to act as receiver on December 22nd, 1937.

"M. K." Electric, Ltd.—The nominal capital has been increased by the addition of £298,000 beyond the registered capital of £2,000. The additional capital is divided into 198,000 ordinary and 100,000 6 per cent. cumulative preference shares of £1.

Amcolite, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 16th, 1937, to secure £13,162 14s. Holders: Progress Foundry, Ltd., Leek New Road, Cobridge, Stoke-on-Trent.

City Notes

The British Vacuum Cleaner & Engineering Co., Ltd.—At separate meetings of the holders of redeemable preference shares, followed by an extraordinary general meeting held on January 17th, resolutions were submitted increasing the borrowing powers of the directors to a sum not exceeding twice the nominal amount of the share capital of the company for the time being issued, and increasing the capital to £550,000 by the creation of 1,200,000 new ordinary shares of 5s. each, to rank *pari passu* with the 400,000 ordinary shares of the existing capital. Mr. H. C. Booth (chairman and joint managing director), who presided, said that the continuing expansion of the business rendered it necessary for the company to obtain further financial facilities, which their bankers were willing to provide on advantageous terms. There was no intention of exercising their borrowing powers to the full, but it was thought desirable to obtain ample borrowing powers, since if the company's business continued to increase, additional finance would be required from time to time. No immediate issue of any of the proposed new ordinary shares was under consideration. Both resolutions were carried.

Turner & Newall, Ltd., held their annual meeting on January 13th, when Mr. G. S. Newall, who presided in the absence of Mr. S. Turner, chairman, read Mr. Turner's speech. Referring to the electrical products department of Turners Asbestos Cement Co., he said that "Everite" asbestos cement cable conduits were now being extensively used, not only by various municipalities for underground power cables, but, on an even larger scale, by the P.O. for underground telephone cables, and during the past twelve months the Widnes works of this branch had manufactured for the G.P.O. alone conduits totalling in length nearly 500 miles. The use of their products in the electrical insulation field had also extended considerably during the past year, and though these products were primarily produced to meet the demands of the electrical industry, they were now being used to an increasing extent in the steel and iron industries. With regard to Newalls Insulation Co., during the year they had perfected a process of manufacture for the production of moulded asbestos for the fire protection of steelwork generally in power stations, substations, and distribution centres, the protection of cables and oil-immersed switchgear.

R. B. Pullin & Co.—Presiding at the annual meeting on January 12th Mr. R. B. Pullin (chairman) said that since the statutory meeting they had further substantially increased the works, and these extensions were now occupied and would be shortly working to full capacity. They were operating at far greater pressure than previously in their history, there had been no falling off in orders, and they had work in hand to keep the factory fully occupied for a very considerable time ahead.

The Singapore Traction Co. has announced a final dividend of 5 per cent. on the ordinary stock, making 7½ per cent. for the year ended September 30th last. For 1935-36 a first and final payment of 5 per cent. was distributed.

J. & E. Hall, Ltd., have declared a dividend of 7 per cent. on the ordinary shares for the year ended September 20th (against 8½ per cent.).

The Yorkshire Electric Power Co. is paying a final ordinary dividend of 5 per cent., making 8 per cent. for the year (unchanged).

Stocks and Shares

TUESDAY EVENING.

THE political crisis in France and the fear of the Chinese-Japanese war being long-protracted, have had little effect in checking the pronounced readiness of money to seek Stock Exchange markets for its employment. So far as the French crisis is concerned, this has brought a good deal of additional capital into the purely investment markets on this side. In the advance that has taken place amongst British Government and similar securities, the stocks of the various electricity boards have not been overlooked, although the quotations, nominally, are unchanged on the week. It becomes increasingly difficult, however, to obtain the offer of any substantial line of stock. Industrial investment shares are attracting no particular attention at the moment, demand being more concerned with purely gilt-edged securities, on the one hand; and, on the other, with the speculative propositions of the gold mining groups. The Stock Exchange business shows a tendency to broaden out. There is some talk of the likelihood that new issues will begin to make their appearance in the near future with greater frequency than they have been doing for the past few weeks.

The Industrial Markets

Among the fifty-odd shares quoted in this letter in electricity supply and equipment companies, there is scarcely a sixpenny change to be recorded on the week's price movements. This makes a telling comment on the quietude of industrial markets as a whole. There are, nevertheless, one or two points of interest. One is the continued strength of Lancashire Dynamos, which at $3\frac{2}{16}$, are another $\frac{1}{16}$ to the good. The yield on last year's dividend is still over 5½ per cent. and, what is more, the interim dividend has since been raised from 5 to

7½ per cent. Switchgear and Cowans, at 18s. 9d., have lost some of their recent firmness. Crabtree Electricals have fluctuated between 27s. and 27s. 9d. On the dull side are Walsall Conduits, at 23s. 9d., and Automatic Telephones, at 40s. 9d. Crompton Parkinson new shares are 29s. 6d. During the certain amount of confusion which arose over the question of rights to the new issues, Ismay Industries slipped back to 5s. 6d., but recovered to 5s. 9d.

Edmundsons New Shares

Offered to shareholders at 30s., Edmundsons Electricity Corporation new shares now command a premium of 6s. 6d. This rise in the premium brings the price more nearly into line with that of the old shares, standing at 37s. ex-rights. Seeing that the new can still be transferred in the form of stamp-free allotment letters, they are considered cheaper than the old. On the promised dividend of 9 per cent., the prospective yield of only 1s. under 5 per cent. is held by many people to be an attractive return from an investment of this class. The cautious attitude adopted towards shares in holding companies, because of their uncertain position under the coming legislation, has been lightened by the conclusions to be drawn from the action of Edmundsons in deciding to raise fresh capital at the present time. The market expects that the reorganisation Bill will be introduced in about a month's time, and that it will present a tamer appearance than might have been inferred from the Government's first proposals.

Ensign Lamps

Unofficial reports of the company's progress have lately been helping an upward trend in the price of Ensign Lamps 5s. ordinary shares. These were first dealt in less than a year ago, and received in October a dividend of 10 per cent., covering a six months period. An interim dividend of the same amount is now declared in respect of the year ending next June. Estimates of what this year's final payment is likely to be are, of course, a matter of guess-work; nevertheless, from calculations that earnings for the current year may be in the region of 40 per cent. of the issued capital, it is being argued that a total payment of 25 per cent. for the year would be a not unreasonable expectation. The shares are quoted at 13s. 9d., ex-dividend, so that, provided estimates prove to be somewhere near the mark, the yield will be on the generous side.

Westinghouse Brake Dividend

Market expectations were fulfilled by the declaration of a 10 per cent. dividend, plus a 7½ per cent. cash bonus, on Westinghouse Brake and Signal ordinary shares. For last year the distributions totalled 2½ per cent. less. A fall of about 1s. to 59s. 6d., ex-dividend, in the price of the shares, reflects a little selling on the part of those who had pitched their expectations of the dividend as high as 20 per cent. Satisfaction is felt with the advance shown in the preliminary profits statement. From the fact that not much more than half the available profits are being distributed, it is obvious that a cautious policy is being continued for the benefit of the balance sheet. On the latest dividend, Westinghouse Brake shares give a yield of £5 17s. 6d. per cent. on the money. Through its holding of these shares, the Consolidated Signal Company will receive a dividend calculated to be equivalent to approximately 36 per cent. on the ordinary capital. Assuming a fairly liberal distribution of this revenue, it is reckoned that Consolidated Signal shares, quoted now at 5⅞, will show a yield higher than that given on the operating company's shares.

Brazilian Tractions

After a further spell of anxiety and doubt over the position of the Brazilian Traction company, the price of the stock has hardened to 11⅛. Latest apprehensions related to the new exchange regulations imposed on balances of foreign money in Brazil. It was thought that Brazilian Traction might find difficulty in transferring the cash necessary for payment of the last-declared dividend. However, it has yet to be made clear that the company's financial affairs are affected by the new decree; it is believed, in any case, that funds sufficient to meet the dividend payment are held outside the country. These considerations have helped to quieten some of the uneasiness arising out of the confusion which has characterised Brazilian affairs since dictatorship stepped into power.

Miscellaneous Matters

News that legislation is being introduced in Japan for bringing the electricity supply industry under State control is of interest in this country mainly to holders of Tokyo Electric 6 per cent. bonds. The price of these has fallen further this week to 52. Cable and Wireless ordinary has sagged a point to 65, but Globe Telegraph preference at 13¾ are ⅛ better. Marconi-Marines at 29s. 6d. have lost 6d. of last week's advance. Interest in Anglo Argentine Tramway debentures took a dull turn, with the result that the 4 and 4½ per cent. issues, at 40 and 30 respectively, are each about 4 points down. The American utility shares have undergone no particular change. Speculation toys with the possibilities that may eventuate from two important conferences called for this week by President Roosevelt. It is stated that the General Electric and the Babcock & Wilcox companies have received large contracts this week for power station equipment for South Africa. General Electrics at 77s. 6d. and Babcocks at 43s. 9d. are unchanged in price.

Share List of Electrical Companies

	Dividend. Nom.	Previous.	Last.	Price Jan. 18.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	67/6	—	4 9 0
City of London	1	7½	7½	34/-	—	4 8 3
Clyde Valley	1	7	8	2	—	4 0 0
County of London	1	10½	10½	49/-	—	4 5 9
Edmundson's 7% Pref.	1	7	7	33/-	—	4 4 10
Do. Ord.	1	8	9	37/-	+6d.	4 17 3
Elec. Dis. Yorkshire	1	9	9	41/6	—	4 6 10
Elec. Fin. and Securities	1	12½	12½	2⅝	—	4 15 3
Elec. Supply Corporation	1	11	12	52/6	+6d.	4 11 5
Lancs Light and Power	1	7½	7½	33/6	+6d.	4 9 7
Lond. Assoc. Electric	1	—	7	31/3	—	4 9 6
London Electric	1	7	8	35/6	—	4 10 2
London Power Deb. Red.	Stock	5	5	107½	+½	4 13 0
Metropolitan	1	10	10	45/-	—	4 9 0
Midland Counties	1	7½	8	37/6	—	4 5 0
Mid. Elec. Power	1	8	9	2 1/16	—	4 7 4
North Eastern Electric Ordinary	1	6	7	32/-	—	4 7 6
Do. 7% Pref.	1	7	7	34/-	—	4 2 4
Northampton	1	10	10	45/-	—	4 9 2
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	47/6	—	4 4 2
Do. do. 6% Pref.	1	6	6	30/-	—	4 0 0
Scottish Power	1	8	8	37/-	—	4 6 5
South London	1	7	7	32/6	—	4 6 2
Whitehall Elec. Invst 7½% Pref.	1	7½	7½	21/6	—	6 19 6
Yorkshire Elec.	1	8	8	39/6	—	4 1 0
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	113	—	4 8 6
Do. 1955–75	„	5	5	116	—	4 6 2
Do. 1951–73	„	4½	4½	109	—	4 2 7
Do. 1963–93	„	—	3½	98	—	3 11 5
London Elec. Trans. Gtd.	„	—	2½	90	—	2 15 7
London & Home Counties, 1955–75	„	4½	4½	110	—	4 1 10
London Passenger Transport, A	„	—	4½	118½	—	3 16 3
Do. do. B	„	—	5	120½	—	4 3 0
Do. do. C	„	4	4½	79½	—	5 7 0
West Midlands Joint Elec. 1948–68	„	—	5	112	—	4 9 3
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$160	9	9	147½	—	6 2 0
Anglo-Am. Tel. Pref.	Stock	6	6	114½	—	5 4 10
Do. Def.	„	1½	1½	28	—	5 7 3
Cable & Wireless 5½% Pref.	„	4½	5½	103	—	5 6 10
Do. Ord.	„	—	—	65	−1	—
Do. Income	„	—	—	101½	—	3 18 10
Globe Tel. & Tel. Ord.	10	4½*	5½*	15½	—	3 13 4
Do. do. Pref.	10	6	6	13¾	+½	4 6 6
Great Northern Tel.	10	20	20	40½	—	4 18 9
Marconi-Marine	1	10	7½	29/6	−6d.	5 1 8
Oriental Telephone Ord.	1	12*	12*	2⅞	—	4 3 6
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	7/6	—	—
Do. do. 2nd Pref.	5	Nil	Nil	4/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	24½	—	—
British Electric Traction Def. Ord.	„	5	5	1037	—	—
Do. do. Pref. Ord.	„	8	8	165	—	4 17 0
Brazil Traction	$100	70 cts.	$1	11⅛	+⅛	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	103½	—	4 14 9
Mexican Light Common	$100	Nil	Nil	2	—	—
Do. 1st Bonds	$500	5	5	35	—	—
Victoria Falls Ord.	1	20	12	3	—	4 0 0
West Riding	1	6½	10	2	—	5 0 0
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	15	15	2	—	7 10 0
Assoc. Elec. Ord.	1	8	10	44/6	−6d.	4 10 0
Do. Pref.	1	8	8	38/-	—	4 4 6
Babcock & Wilcox	1	8	10	43/9	—	4 11 6
British Aluminium Ord.	1	7½	10	47/-	—	4 5 0
British Insulated Ord.	Stock	20	20	4⅛	—	4 4 6
Brush Ord.	Stock	Nil	Nil	25½	—	—
Callender's	1	15	15	4 7/16	—	3 9 1
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord.	5/-	12½	12½	30/-	—	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	7	10	1⅜	—	5 14 4
Enfield Cable Ord.	1	25	25	5½	—	4 17 8
English Electric	1	Nil	Nil	31/-	—	—
Do. do. Pref.	1	6½	6½	25/6	—	5 2 0
Ericsson Tel.	5/-	20	25	2½	—	2 18 10
Ever Ready	5/-	35	45	26/-	—	8 13 2
Ferranti Pref.	1	7	7	27/6	—	5 1 10
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	15	17½	77/6	—	4 10 2
Henley's	5/-	30	15	18/9	—	4 0 0
Do. 4½% Pref.	1	4½	4½	1⅛	—	4 0 0
India-Rubber Pref.	1	5½	5½	21/3	—	5 3 6
Johnson & Phillips	1	½	10	40/9	—	4 18 0
Lancashire Dynamo	1	10	20	3 3/16	+1/16	5 12 4
Siemens Ord.	1	6	7½	28/9	—	5 4 4
Telegraph Construction	£1	Nil	7½	2⅜	—	3 3 0

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1936

8287. "Electric furnaces." W. W. Triggs. (Y. R. Cornelius.) March 19th, 1936. (477027.)

11056. "Separating filter for oscillating electric currents." W. Cauer and W. Brandt. April 17th. (477209.)

13967. "Aerial systems for radio receivers." F. R. W. Strafford and Belling & Lee, Ltd. May 16th, 1936. (477031.)

14289. "Television and the like." Philco Radio & Television Corporation. June 7th, 1935. (477038.)

14382. "Automatic control means for electrically driven tools." Photosculpture, Ltd., and S. T. Jeffreys. May 21st, 1936. (477085.)

14536. "Electric fuses." General Electric Co., Ltd., and J. W. Gibson. May 22nd, 1936. (477152.)

17138. "Multiple cathode-ray tube." Radioakt.-Ges. D. S. Loewe. June 20th, 1935. (477043.)

17151. "Heat-exchange apparatus for fluids applicable to coolers for enclosed dynamo-electric machines, and for other purposes." R. Poole and Metropolitan-Vickers Electrical Co., Ltd. June 19th, 1936. (Cognate application 34486/36.) (477276.)

17343. "Means for connecting aerials to radio receivers." A. G. Haslam, F. R. W. Strafford and Belling & Lee, Ltd. June 22nd, 1936. (477281.)

17350. "Electrical transmission-line insulators." C. A. Burnier (J. M. Somerville). June 22nd, 1936. (477157.)

17495. "Locks and keys, also applicable to electric switches." H. J. Buchanan Wollaston. June 24, 1936. (Cognate applications, 19500/36, 26353/36, 28682/36, 31883/36, 32466/36 and 33130/36.) (477160.)

17552. "Television systems." British Thomson-Houston Co., Ltd. July 25th, 1935. (477216.)

17629. "Wireless receiving apparatus." E. S. V. Truefitt. June 25th, 1936. (477048.)

17978. "Radio receiving apparatus." General Electric Co., Ltd., and W. H. Peters. June 29th, 1936. (477217.)

18611. "Indicators for iron-clad electric switches." J. B. Tucker. July 4th, 1936 (addition to 425705). (477166.)

19372. "Electromagnetic pickups." Cosmocord, Ltd. (W. M. Braun). July 13th, 1936. (477172.)

19749. "Tuning-scales for radio receivers." Murphy Radio, Ltd., and J. D. A. Boyd. July 16th, 1936. (477096.)

19890. "Radio communication systems." Standard Telephones & Cables, Ltd. September 26th, 1935. (477175.)

20087. "Protective devices for high-tension d.c. electrostatic precipitation plant." English Electric Co., Ltd., W. Donnelly and R. D. Ball. July 20th, 1936. (477177.)

20151. "Junction boxes for electrical wiring conduits, boxes for electric switches and analogous fittings." E. J. Trawford. July 21st, 1936. (477097.)

21303. "Loaded electric transmission lines." L. N. Brillouin. August 7th, 1935. (Cognate application 21304/36.) (477059.)

22434. "Electrically operated calculating apparatus." Siemens Bros. & Co., Ltd., J. H. Broome, A. A. Southam and A. F. Wood. August 14th, 1936 (addition to 441643). (477101.)

25745. "High-pressure metal-vapour electric-discharge devices." General Electric Co., Ltd., V. J. Francis and J. W. Ryde. September 22nd, 1936 (addition to 461211). (477105.)

27214. "Electric contacts for switches, fusible cut-outs, and the like." Callender's Cable & Construction Co., Ltd., and H. C. Bewers. October 7th, 1936. (477108.)

30526. "Electromagnetic coils for loudspeakers and telephone receivers." R. Stolojian. November 9th, 1935. (Addition to 462224.) (477227.)

31442. "Make-and-break switches having arc-extinguishing arrangements." General Electric Co., Ltd., and C. W. Stopford. November 17th, 1936. (477113.)

31740. "Method of, and apparatus for, operating self-synchronous motors, and the application thereof to the measurement of rotational velocity." Submarine Signal Co. (London), Ltd. (Submarine Signal Co.). November 19th, 1936. (477114.)

34759. "Devices with arc-extinguishing means for interrupting electric current." F. Strauss (née Ruppel). (Legal representative of S. Ruppel, dec.). December 17th, 1935. (477231.)

1937

1828. "Fluorescent screens." British Thomson-Houston Co., Ltd. January 22nd, 1936. (477192.)

2054. "Electrical steering gears for ships." F. Johnston and F. E. Rebbeck. January 23rd, 1937 (477071.)

5031. "Thermionic-valve circuits." Standard Telephones & Cables, Ltd. May 16th, 1936. (477240.)

13108. "Machines for making electric lamps or similar devices." British Thomson-Houston Co., Ltd. May 8th, 1936. (477250.)

13113. "Casings of moulded material for prepayment electricity and like meters." Siemens-Schuckertwerke Akt.-Ges. July 1st 1936. (477138.)

13114. "Commutators for dynamo-electric machinery." Siemens-Schuckertwerke Akt.-Ges. May 8th, 1936. (477251.)

13564. "Television and like transmitters." Telefunken Ges. für Drahtlose Telegraphie. May 13th, 1936. (477253.)

14382. "Electrical contact lugs." Cinch Manufacturing Corporation. June 18th, 1936. (477255.)

14730. "Synchronous motor clocks and synchronous motor clock systems." Siemens & Halske Akt.-Ges. May 27th, 1937. (Addition to 466692.) (477256.)

16625. "Electric contact devices." British Thomson-Houston Co., Ltd. June 15th, 1936. (477078.)

16778. "Electric circuit-breakers having arc-extinguishing means. Allmänna Svenska Elektriska Aktiebolaget. June 20th. 1936. (477260.)

17234. "Electric-discharge tubes comprising secondary-emission electrodes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 23rd, 1936. (477262.)

21739. "Electric arc lamps." K. Lustig. August 6th, 1937. (477267.)

24151. "Space discharge-tube circuit." Standard Telephones & Cables, Ltd. October 6th, 1937. (477270.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 12th:—

Alnor (lettering and design). No. 574033. Class 8. Pyrometers, thermo-couples, resistance temperature measuring instruments, ohmmeters, electric meters, &c.—Illinois Testing Laboratories, Inc., Chicago, Ill., U.S.A. (British representatives: Frank B. Dehn & Co., Kingsway House, 103, Kingsway, W.C.2.

Viavox. No. 572683. Class 8. Electrically operated loud speakers, diaphragms for electrically operated loud speakers, microphones, diaphragms for microphones, electrical transformers (not being machines) for use in sound amplifying and producing apparatus, and apparatus comprising variable electrical resistances for controlling the input of electrical impulses or oscillations to thermionic amplifiers.—Alfred and Leonard Young, trading as Viavox Acoustics, Ashford Works, Ashford Road, Cricklewood, N.W.2.

Cameo. No. 579354. Class 8. Radio receiving sets, radio gramophones and television receiving sets.—R.S.C. Radio, Ltd., 1, Belmont Street, Chalk Farm, N.W.1.

Tempomat. No. 581541. Class 8. Apparatus used in welding for timing electric impulses by means of thermionic relay valves.—Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.

Summit. No. 581998. Class 11. Instruments, apparatus and contrivances, not medicated, for surgical or curative purposes, or in relation to the health of men or animals.—S. & R. J. Everett & Co., Ltd., 939, London Road, Thornton Heath, Surrey.

Duroid. No. 581240. Class 13. Welding electrodes and welding rods of ordinary metal.—The Quasi-Arc Co., Ltd., Thames House, Millbank, Westminster, S.W.1.

White Cross (lettering and design). No. 574979. Class 18. Electric cooking stoves and ranges.—National Stamping and Electric Works, Chicago, Ill., U.S.A. (British representatives: Frank B. Dehn & Co., Kingsway House, 103, Kingsway, W.C.2.

Carrier. No. 578981. Class 18. Air conditioning and ventilating systems, warming and heating plant for buildings, &c.—Carrier Engineering Co., Ltd., 24, Buckingham Gate, Westminster, S.W.1.

Aoba. No. 580209. Class 18. Electrically operated junctions, being installations of overhead electrical transmission wiring.—The Anti-Attrition Metal Co., Ltd., Glengall Works, Glengall Road, S.E.15.

The Electrical Outlook in Canada

OPTIMISM regarding the outlook for the electrical service and equipment industry in Canada is voiced by Mr. D. C. Durland, president of the Canadian General Electric Co., Ltd. In a review of business in 1937, and of the prospects for the current year, Mr. Durland says that the demand for electrical service and equipment in Canada continues to expand, and the production of electricity by central stations during the past year was the highest on record, exceeding that of 1936 by about 8 per cent. This increase is largely attributable to the expansion of Canadian industries which export the major portion of their products and to the increasing use of electrical appliances for domestic purposes and of electrical equipment for efficient production in industry. An outstanding development of the past few years has been in the mining field, and there is a steady increase in the use of electrical power for mining and for the metallurgical treatment of ore and allied manufactures. The largest industrial consumer, however, is the pulp and paper industry, which takes about 40 per cent., of all the energy produced by central stations, in addition to that generated by its own power plants. To these two major industries must be added many others which consume an increasing proportion of electrical energy.

With a total population relatively small as compared with national resources, and with very high per capita production and trade, it is not surprising that the consumption of electricity of the average home in Canada is high, and in fact double that in the United States. The chief factor that enables Canadians to enjoy the benefits of electricity to such a large extent is its comparatively low cost, which averages for domestic services 2.08 cents per kWh, as compared with slightly over 5 cents in the United States. The Canadian householder is definitely electrically minded. Many of the new houses being built in Canada are completely electrified, being equipped with adequate wiring, modern lighting, electric kitchen, laundry and refrigeration, radio and, in many cases, air-conditioning. Canada has now over 1,400,000 electrically wired residences, representing 62 per cent. of all homes in Canada, and power lines are constantly being extended into the country, bringing more and more the benefits of electrical service to rural areas. It is estimated that power lines serve well over 60,000 farms in Canada.

The Canadian electrical industry is progressive and enterprising and through its engineering and research departments is constantly improving existing equipment and developing new products for generating plants, manufacturing establishments and the home. The consumption of electricity and the production of electrical equipment are destined to be well sustained and to expand unless retarded by adverse and uncontrollable external conditions.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberystwyth.—Houses (80), Penparcau site; borough surveyor.

Barking.—Extensions to Barking Hospital, Upney Lane (£38,800); secretary.

Barnet.—Extensions to Wellhouse Hospital; Alfred Saxon Snell & Phillips, architects.

Barnstaple.—School, Vicarage Street (£27,728), for the E.C.; borough surveyor.

Bedfordshire.—Police station, Biggleswade (£14,175) and court house, Leighton Buzzard (£15,703), for the C.C.

Birmingham.—Factories, Bradford Street, and Cheston Street, Aston; Maddocks & Walford, builders, Tyburn Road, Birmingham. Factory and offices, near Doe Street; C. Bryant & Son, builders, Small Heath. Shops, Shirley Road; Dare & Son, builders, Ward End, Birmingham. Welfare centre (£7,510), Treaford Lane, Alum Rock; Harrison & G. B. Cox, architects, 109, Colmore Row, Birmingham.

Blackpool.—Houses (46), Bispham estate; borough surveyor.

Bridlington.—Houses (22), Flixton and Folkton; C. F. Johnson, architect, Midland Bank Chambers, Westgate.

Bristol.—Cinema, Filwood Broadway (£13,000); F. G. W. Chamberlain. Council offices (£420,000); Wm. Cowlin & Son, Ltd. Estate development of Brislington; Northville Building Co. School, Petherton Road (£19,994); E. A. W. Poole & Son.

Cambridge.—Cinema, Guildhall Place, for Odeon Cinema Holdings, Ltd.; T. C. Howitt, architect, Exchange Buildings East, Nottingham.

Cannock.—Houses (100); R.D.C. surveyor, Penkridge.

Chelmsford.—Development of Patchinghall estate; W. Dawes. Estate development, near Springfield Road; Prickett & Ellis.

Cheshire.—Court house, Heswall (£13,980), for the C.C.

Chesterfield.—Houses (59), Marsh Lane (£20,540); R.D.C. surveyor.

Colchester.—Houses (106), Berechurch Road; Baron Estate Co., Ltd.

Cornforth (Co. DURHAM).—Houses (26), J. & S. Bernstein, builders, Sedgefield.

Cowdenbeath.—Houses (48), burgh surveyor.

Cwmbran (MONMOUTHSHIRE).—Houses (42), Upper Cwmbran; A. F. Viney, housing surveyor, Council Offices.

Dartford.—Houses (170), with shops and flats, near Francis Road; P. C. Brazier, Burnham Road, Estate Office.

Deal.—Additions to Central school, including gymnasium (£12,888), for the E.C.; S. F. Price, clerk of works.

Devonshire.—School, Honicknowle, St. Budeaux (£13,315), for the C.C.; W. D. Coles, contractor, Bath Street, Plymouth.

Dorset.—School, Wareham; Broad & Docker, surveyors, 44, Holdenhurst Road, Bournemouth.

Droylsden.—Factory, for Co-operative Wholesale Society, Ltd.

Ewell.—Cinema, Kingston Road; W. H. Gaze & Sons, Ltd., contractors, Kingston-on-Thames.

Falkirk.—Cinema, Camelon (£7,000), for Camelon Picture House Co.; Stell Macs, Ltd., builders, 57, Oswald Street, Glasgow.

Felixstowe.—Alterations, &c., to Spa Pavilion (£12,298); Rogers Bros., Ltd., contractors, Station Road.

Friern Barnet.—Municipal offices, depot, &c. (£44,500), site of present Council Offices; U.D.C. surveyor.

Gatwick.—Extensions (£250,000) to airport; Airport, Ltd.

Glasgow.—Houses, at Balornock and Robroyston (£1,000,000); architect, housing department. Sports stadium, Bothwell Street (£200,000); J. K. McDowall, solicitor, 115, St. Vincent Street. Extensions to Crossmyloof Ice Rink (£20,000); the manager.

Gloucestershire.—Clinic, Filton, for County Council.

Gorleston-on-Sea.—Police station, Lowestoft Road (£6,990); E. Moore & Son, Ltd.

Gosport.—School, Privett Road (£30,922), for the E.C.

Hagley.—School; A. V. Rowe, architect, Foregate Street, Worcester.

Halesowen.—Extension to factory, Prospect Road; National Tube Co., Ltd.

Halstead (ESSEX).—Houses (92), (£31,034); Jepp & Sons, contractors, Braintree.

Hastings.—Houses (240), Red Lake estate; borough engineer.

Hertfordshire.—School, Durrants estate, Croxley Green, Rickmansworth, for the C.C.; clerk of the County Council, Education Office, Hertford.

Hornchurch.—Development of Maylands Farm estate; Smith & Blanks.

Hove.—Two swimming baths, café, covered car park, &c., St. Aubyns site, Medina Esplanade; T. R. Humble, Town Hall.

Irthlingborough.—Council offices and council chamber, High Street; E. Turnbull, U.D.C. surveyor.

King's Lynn.—School, Gaywood Park estate (£49,343) for the E.C.

Leeds.—Branch library, Cross Gates (£20,104); city surveyor.

Leighton Buzzard.—Houses (36), Mill Road and Baker Street site; B. H. Robjant, U.D.C. surveyor, Council Offices.

London.—(CATFORD).—Cinema and shops, Bromley Road; A. Mather, Leicester Square Chambers, Leicester Square, W.C.2.

Lowestoft.—Enlargement of Dell Street school (£15,000) for the E.C.

Manchester.—Clinic, Shatstone; city architect.

Melford.—Houses (203); R.D.C. surveyor, Sudbury.

Middleton.—Houses (214), Acresfield Road; Pine Estates, Ltd. Factory extensions, for Co-operative Wholesale Society, Ltd.

Motherwell.—Premises (£30,000), Mersey Street, for Dalziel Co-operative Society, Ltd.

Newbury.—Factory extensions, for Elliotts (Newbury), Ltd., Albert Road.

Newcastle-on-Tyne. — Extensions to General Hospital (£25,000) for the C.C.; city architect.

Newton Heath (MANCHESTER).—Cinema, Church Street (£20,000), for Magnet Cinema (Newton Heath), Ltd.; J. A. Dargie, architect, 139, Chapel Street, Blackfriars, 3.

Northamptonshire.—Police houses (£9,400) for the County Council. Schools, Durton (£26,640), and extensions to Boot and Shoe Institute, Kettering (£7,800), for the County E.C.

Northern Ireland.—(BELFAST).—Broadcasting house (£70,000), for the B.B.C.; T. Tudsbury, B.B.C.'s civil engineer.

Norton (MALTON).—Houses (100), seven sites; R.D.C. surveyor.

Paignton.—Houses (43), Colley End Road; Eastley & Co.

Peterborough.—School, Mountsteven Avenue, Walton, for the City E.C.; S. Dodson & Son, architects, Museum Buildings, Priestgate.

Plymouth.—Houses (116), Peter's Park Lane, St. Budeaux; city architect, Guildhall.

Pontefract.—Houses (18), Monkhill Lane; E. Cockshaw.

Preston.—Extensions to premises (£70,000), Lancaster Road, for Preston Co-operative Society.

Pwllheli.—Houses (58), Morfa Garrey; borough surveyor, Town Hall.

Reddish.—Extensions to printing works (£83,000), for Co-operative Wholesale Society, Ltd.

Rotherham.—School, Clough Park, for the E.C.; V. Turner, borough engineer.

Rothwell.—Houses, Green Lea estate, Oulton; A. Armitage & Co., Ltd., contractors, Stourton, and J. H. Reynard (Otley), Ltd., Sunnydale, Bradford Road, Otley.

Rugby.—Houses, Millfields estate and Bloxham Gardens, Bilton Road; W. H. Adams & Sons, 35a, Regent Street. Houses (12), Percival Road; J. Boyce, 73, Lawford Road. Cinema, Hillmorton Paddox, for Plaza Theatre (Rugby), Ltd. Additions to factory, Lawford Road, New Bilton, for Rugby Portland Cement Co.

Rutherglen.—Police headquarters and fire station; burgh surveyor.

Saddleworth.—Houses, Heathfields; Shaws, Uppermill; Horsforth, Greenfield, and Cooper Street, Springhead; Dixon, Hill & Co., architects, 52, Union Street, Oldham.

Salford.—School, Lancaster Road, Pendleton, for the E.C.; P. Howard, architect, 88, Mosley Street, Manchester.

Seaton Delaval (NORTHUMBERLAND).—Houses (180); S. E. Burgess, architect, Council Offices, Shiremoor.

Shotley Bridge.—Houses; Ayton & Sons, builders, George Street, Blackhill.

Smethwick.—Houses (46), Londonderry Road (£20,507); borough surveyor.

Southampton.—Houses (48), Redbridge Hill site; Borough Engineer's Department, Civic Centre.

Southport.—Houses (15), Lincoln House site; borough engineer.

South Shields.—Houses (18), Northfield Road; W. J. Robertson & Sons. Trolley bus depot (£3,150); borough engineer. Alterations to Palace Theatre, Frederick Street; Theatre Co.

Stockport.—Cinema, London Road, Poynton, for the directors; R. Bailey, contractors, "Chestnuts," Chester Road, Poynton. School, Didsbury Road, Heaton Moor; L. Yates, education architect, Education Offices.

Stranraer.—Houses (78); burgh surveyor.

Stretford.—Houses (318), Barton Road estate; E. Parker, borough surveyor.

Sunderland.—Flats and shops, Hartley Street; J. Lewis, borough engineer.

Surrey.—School, Beare Green, for the County E.C. School, Lightwater (£11,477); Crosby & Co., Ltd., builders, Farnham.

Swansea.—Houses (29), Plasmarl; J. C. Oliver. Cinema, High Street, for Odeon Theatres, Ltd., Cornhill House, Bennett's Hill, Birmingham. Houses (18), Wimmerfield Avenue; S. Davies.

Swinton.—Extensions to works, Clifton Junction; Magnesium Elektron, Ltd. Houses (31), Moss Lane area; Bridgewater Estates, Ltd.

Taunton.—Houses (186), Halcon & Lyngford estates; borough surveyor.

Tynemouth.—Hotel, opposite the Grand Parade; J. R. Wallace, architect, 20, Northumberland Square, North Shields.

Wakefield.—Houses (230), Flanshaw estate; borough surveyor.

Wallsend-on-Tyne.—Development of Low Willington Farm estate (houses, hotel and cinema); North Heaton Development Co., 40, Grey Street, Newcastle-on-Tyne.

Wellingborough.—Factory, Weavers Road, for the Ideal Clothiers, Ltd.; C. Adams & Co., contractors, Finedon Road.

Weymouth.—School; Broad & Docker, surveyors, 44, Holdenhurst Road, Bournemouth.

Whitefield.—Houses and bungalows, Fountain Street; J. Knight, U.D.C. surveyor.

Wiltshire.—School (£44,154), for the Chippenham County E.C.

Worcestershire.—School, Homer Hill, Cradley, for the E.C.; county architect, Worcester.

Workington.—Houses (44), Shore Road, Salterbeck; J. Penman, borough surveyor.

Worksop.—Glass works (£68,500), for Co-operative Wholesale Society, Ltd.